Background Study No 3

FISHERIES in the ATLANTIC PROVINCES

Canada

ATLANTIC DEVELOPMENT BOARD

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FOREWORD

This report is the third of a series initiated by the Atlantic Development Board to examine important aspects of the economy of the Atlantic Region. It was prepared as a background document for public discussion of regional development policies.

The Atlantic Development Board Act authorizes the Board to prepare "... an overall co-ordinated plan for the promotion of the economic growth of the Atlantic Region". The various studies that the Board has prepared provide the basic facts on which development policies will be formulated. They are being published to contribute to public understanding and discussion of the major policy issues in the economic development of the Atlantic Provinces.

The Atlantic fishery, more than any other resource industry, is intimately bound to the history and traditions of the people of the Atlantic Provinces. It has been the subject of many reports, studies and plans. Commercial fishing is a major concern of government departments of fisheries, both federal and provincial. This report makes no attempt to duplicate work that has gone before. Rather, it attempts to assess the economic potential of the primary fishery and the fish-processing industries in the Atlantic Provinces over the next decade, and to discuss some of the indicated adjustments required to move toward realization of that potential.

A.D. Crerar of the Atlantic Development Board planning staff had over-all responsibility for the analysis of data and preparation of the report. Much of the basic descriptive material was assembled for the Atlantic Development Board by D.A. MacLean, now regional economist for the Canada Department of Fisheries in Halifax. The Economics Branch of that Department, in both Halifax and Ottawa, provided much assistance and advice. Editing was by J.F. Kinzel.

The study was conducted in consultation with the Federal-Provincial Atlantic Fisheries Committee, whose members include:

Leonce Chenard, Deputy Minister, New Brunswick Department of Fisheries, Fredericton;

Eugene Gorman, Deputy Minister, Prince Edward Island Department of Fisheries, Charlottetown;

E.M. Gosse, Deputy Minister, Newfoundland
Department of Fisheries, St. John's;

Brian Meagher, Deputy Minister, Nova Scotia
Department of Fisheries, Halifax;

Dr. A.W.H. Needler, Deputy Minister, Canada
Department of Fisheries, Ottawa.

The Committee's participation in an advisory capacity, of course, does not imply any measure of responsibility for the report or its findings.

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FISHERIES IN THE ATLANTIC PROVINCES

1. DEVELOPMENT OF THE ATLANTIC FISHERY

Fishing in the waters surrounding the Maritime Provinces and Newfoundland began in the early 16th century. Although international, the fishery was not initially land-based on this continent. Some settlement took place in the 17th century, but it was not until the following century that colonization began in earnest. The early east coast fishing industry was based upon the virgin cod fishery for the production of salted fish. Codfish remained the dominant species until late in the 19th century when the lobster began to assume greater economic importance.

The introduction of the gasoline engine for use in small boats in about 1905 revolutionized some segments of the inshore fishery. A few years later the first steam otter trawlers were introduced, only to meet extreme opposition from those dependent upon inshore operations. Restrictions were placed on fish dragging operations at the request of the inshore operators, and it was not until the 1940's that the rigid restrictions on dragger utilization were relaxed.

It appears that most of the early innovations introduced into the Canadian east coast fishery were first adopted in New England, later introduced in the Maritime Provinces and eventually in Newfoundland (filleting at source of production, gas engine, freezing, etc.). The development of filleting plants and freezing led to the utilization of groundfish species in addition to cod, and in the late 1930's the growth in distribution and holding facilities encouraged the frozen sector of the industry and increased the shift from the production of salted products.

Generally during periods of international conflict the east coast industry has prospered because of the strong demand for foodstuffs. However, until the last decade progress and development have been generally slow. Since 1955 the Atlantic coast fishery has (with government assistance) progressed rapidly with the addition of modern fishing units, the construction of more efficient plants, improvements in marketing and transportation of products and the importation of fishing techniques commonly used in other parts of Canada and in competing fishing nations.

Approximately 8 per cent of the labour force in the Atlantic Provinces is engaged in the primary fishery sector for all or part of each year. In total, over 45,000 men were employed in the primary fishery in the region in 1965. From 1954 to 1960, the numbers in the industry had generally declined (except in Newfoundland), but after 1960 there was a fairly

sharp increase (Figure 1-1). The bulk of this increase occurred in Newfoundland, with Nova Scotia also showing an upward trend. In any event, there is no recent evidence of any large-scale exodus from fishing.

The majority of those engaged in the primary fishery are not full-time. Although regional statistics are incomplete, it is estimated that, of the 45,500 fishermen in 1965, only about 6,000 were employed for 10 or more months of the year. Some 27,000 could be classed as part-time (5 to 10 months) and 12,500 as occasional workers (less than 5 months).

The primary fishery contributes about 6 per cent to the net value of commodity production within the region. On a provincial basis the contribution in 1965 ranged from 2.2 per cent in New Brunswick to 10.5 per cent in Prince Edward Island. For the region as a whole, the primary fishery has more than maintained its share of net value of commodity production since 1960 (Table 1-1).

TABLE 1-1

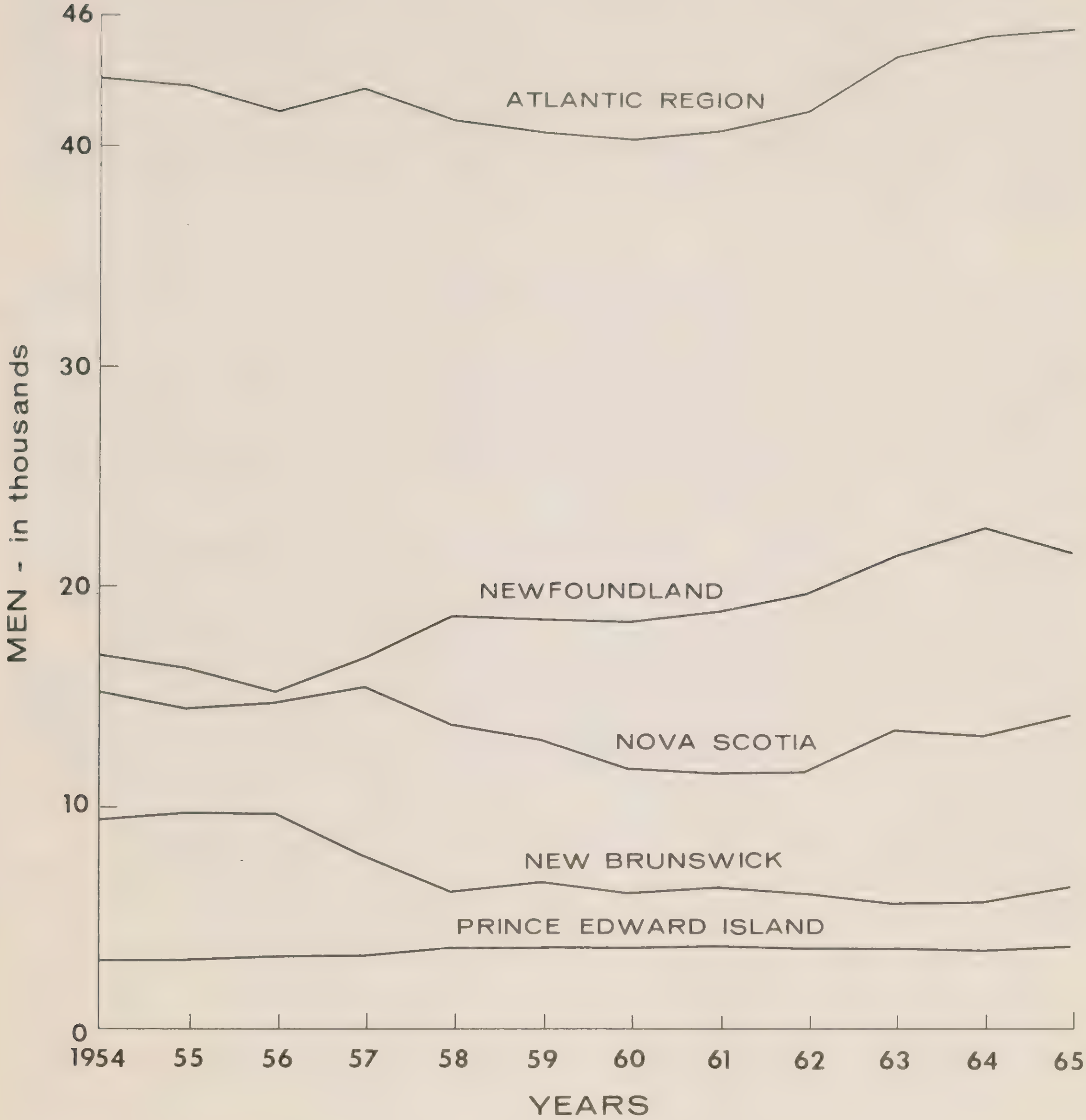
Net Value of Production in Commodity-Producing Industries, Atlantic Region, 1960, 1963 and 1965

Industry	1960		1963		1965	
	$ 000,000	%	$ 000,000	%	$ 000,000	%
Agriculture	82.5	7.8	61.9	5.3	91.1	6.3
Fisheries	55.9	5.3	71.1	6.1	91.2	6.3
Forestry	79.2	7.4	71.1	6.1	57.1	3.9
Trapping	0.3	-	0.4	-	0.5	-
Mining	102.4	9.6	137.4	11.8	217.3	15.0
Electric Power	54.6	5.1	71.1	6.1	84.7	5.9
Manufactures	397.7	37.4	442.3	38.1	514.0	35.5
Construction	290.2	27.3	305.6	26.3	390.9	27.0
Total	1,062.8	100.0	1,016.8	100.0	1,446.9	100.0

Source: Survey of Production 1963, 1965. D.B.S.

FIGURE 1-1

NUMBER OF MEN ENGAGED IN PRIMARY FISHING
ATLANTIC REGION, 1954-65



Source: Economics Branch, Canada Dept. of Fisheries.
(See Appendix Table A-5.)

Although these statistics indicate that the fishery is a rather minor aspect of the regional economy, certain factors disguised in the statistics must be mentioned. The fishing industry is one of the few industries in the region which, historically, have absorbed part of the labour force during times of distress in the economy either during the year, or over a number of years, although it has not done so profitably. Also, the primary fisheries statistics do not include the effect of fish processing, which appears as part of the manufacturing category. During the most recent year for which statistics on employment in fish-processing establishments are available (1965) 10,700 people were employed in this secondary aspect of the industry in the region. It is estimated that fish processing within the region contributed about $53 million (value added) annually, or 9.7 per cent, to the $514 million manufacturing sector in 1965.

Although there are many similarities among the fishing industries of the four Atlantic Provinces, each province tends to have a slightly different species mix which leads to different levels of net return for effort. Nova Scotia has a number of high-value species landed and processed within the province. In Nova Scotia, groundfish landings during 1965 were 379 million pounds with a landed value of $18.4 million. However, the lobster fishery (which yielded 18.6 million pounds valued at $13.6 million) and the scallop fishery (18.5 million pounds valued at $10.3 million) exceeded the value of any individual species in the groundfish group. In Newfoundland, the codfishery accounts for 60 per cent of the landed value of all fishes, while the flounder and lobster fisheries each account for about 10 per cent and the capelin and salmon fisheries 5 per cent each. In Prince Edward Island during 1965, lobster accounted for 70 per cent of the total landed value of all fishes; groundfish landings, 11 per cent. In New Brunswick the annual value of landings is quite evenly distributed among the three main groups of species. The groundfishes accounted for 30 per cent of the total value of landings during 1965 while the pelagic group represented 31 per cent and the molluscs and crustaceans 39 per cent. In New Brunswick, as in the other two Maritime Provinces, lobster is the single most valuable species landed.

2. FISH MARKETING PROSPECTS

A recent report prepared by the Department of Fisheries considered fish marketing prospects to 1975 (Canada Department of Fisheries, 1967). As it relates to the Atlantic fishery, the report concluded that market demand is likely to play a dynamic role only with respect to groundfish and herring. Marketing of other species of economic importance, the report suggests, will be limited more by supply than by the capacity of the market to absorb them. This section, then, considers consumption and marketing of groundfish and herring.

Consumption of Groundfish[1/]

The United States is Canada's primary market for groundfish, absorbing approximately two-thirds of the output of the Canadian Atlantic groundfishery in 1967. The Department of Fisheries report referred to above contains a projection of the growth of the United States market to 1975. However, because of recent events, it is necessary to revise that forecast.

Tables 2-1 through 2-4 provide the basic information for developing the revised groundfish market forecast. From Table 2-1 it can be seen that U.S. consumption of groundfish, as inferred from total domestic disappearance (apparent consumption), has increased substantially over the period since 1955. Compound five-year growth rates in consumption are indicated in Table 2-2. With the exception of the 1958-1963 and 1962-67 periods, the compound growth rates were generally at or above 5 per cent a year.

The yearly rate of change in total consumption is given in Table 2-1.

It will be seen that between 1966 and 1967, the total American consumption of groundfish dropped by 22.3 million pounds, a decline of over 4 per cent from the previous year. The compound annual growth rate in consumption registered a low of 2.5 per cent during the 1962-67 period as compared with about 5 per cent for the previous periods, as indicated in Table 2-2.

1/ Prof. Norman Morse of Dalhousie University is currently preparing a full-scale estimate of demand for groundfish for the Atlantic Development Board. In the meantime, the interim forecasts shown here have been prepared by the Board's Planning Division.

TABLE 2-1

Consumption of Groundfish* in the United States, 1955-1967

Year	Total Supply	Ending Stocks	Apparent Consumption	Annual Change in Apparent Consumption
	--------- 000,000 lb.		----------	%
1955	362.7	51.5	311.2	-
1956	371.9	69.3	302.6	-2.8
1957	373.0	47.8	325.2	7.5
1958	452.2	65.5	386.7	18.9
1959	473.3	87.3	386.0	-0.2
1960	470.4	76.3	394.0	2.1
1961	506.4	68.0	438.4	11.2
1962	538.3	81.7	456.6	4.2
1963	550.2	86.8	463.4	1.5
1964	566.5	73.8	492.7	6.3
1965	609.3	86.0	523.3	6.2
1966	647.1	104.6	542.5	3.7
1967	613.9	93.7	520.2	-4.1

* Groundfish includes haddock, flounders, cod, halibut, ocean perch and fish blocks. Beginning in 1958, fish blocks are entered in the total supply. Supply is made up of beginning stocks, landings and imports.

Source: Food fish situation and outlook, current economic analysis. U.S. Dept. of the Interior, Fish and Wildlife Service, Bureau of Commercial Fisheries. May 1968.

TABLE 2-2

Compound Annual Growth Rates in Consumption of Groundfish, United States, 1955-1967

Period	Growth in Apparent Consumption
	%
5-Year Average	
1955-60	4.8
1956-61	7.6
1957-62	7.1
1958-63	3.6
1959-64	5.0
1960-65	5.8
1961-66	4.3
1962-67	2.5
10-Year Average	
1956-66	6.2
1957-67	4.8

Source: Table 2-1.

TABLE 2-3

United States Per-Capita Consumption of Selected Groundfish Species, 1955-1967

Year	Haddock	Flounders	Cod	Perch
	lb.	lb.	lb.	lb.
1955	.461	.288	.335	.414
1956	.441	.317	.324	.375
1957	.442	.314	.372	.397
1958	.363	.332	.380	.388
1959	.320	.313	.373	.350
1960	.345	.335	.283	.337
1961	.354	.356	.268	.343
1962	.385	.383	.250	.330
1963	.334	.398	.260	.309
1964	.330	.422	.265	.298
1965	.334	.453	.253	.325
1966	.340	.463	.250	.342
1967	.288	.446	.278	.319

Source: Food fish situation and outlook, current economic analysis. U.S. Dept. of the Interior, Fish and Wildlife Service, Bureau of Commercial Fisheries. May 1968.

TABLE 2-4

United States Production of Groundfish* and Imports, 1955-1967

Year	U.S. Production	Yearly Change	Imports	Yearly Change
	000,000 lb.	%	000,000 lb.	%
1955	186.3	-	109.7	-
1956	196.8	-	123.6	-
1957	181.5	-	122.0	-
1958	186.3	-	209.1	-
1959	185.1	-0.6	222.6	6.5
1960	183.9	-0.6	199.2	-10.5
1961	192.8	4.8	237.2	19.1
1962	200.7	4.1	269.9	13.8
1963	195.3	-2.7	273.4	1.3
1964	182.9	-6.3	294.3	7.4
1965	190.2	4.0	345.3	17.3
1966	188.6	-0.8	372.5	7.9
1967	170.6	-0.5	338.7	-10.1

* Includes haddock, halibut, cod, flounder, ocean perch, and fish blocks. Blocks entered production from 1958. Landings converted to fillet weight.

Source: Food fish situation and outlook, current economic analysis. U.S. Dept. of the Interior, Fish and Wildlife Service, Bureau of Commercial Fisheries. May 1968.

Table 2-3 presents the U.S. per-capita consumption of selected groundfish species.

It seems clear that the American Bishop's Decree on Friday fasting in December 1966 was responsible for the short-run decline in consumption during the 1966-1967 period. This conclusion is indicated in a study by Bell (1967). If true, then this represents a once-in-a-lifetime event, and most of the adjustment in consumption would have occurred during 1967. The dynamic elements which had been pushing up consumption prior to 1967 were unrelated to religious obligations. Increases in consumption occurred because more people were finding fish to be economic, convenient, nutritious and tasty. It is believed that these underlying trends toward increased fish consumption will reassert themselves. It is assumed that, starting from the 1967 low, consumption will resume the 5-per-cent growth rate experienced over the 10 years from 1956 to 1966. On this basis, consumption in the American market would surpass 600 million pounds by 1970. By 1975 U.S. consumption could be expected to increase to about 768 million pounds.

During the period 1955-1967, United States production of groundfish has been declining somewhat (Table 2-4). The pattern has been one of a very slow decline in production. At some point resistance to continued decline will be felt, presumably when the core of efficient vessels is reached, supported by recent government subsidy programs. Given this assumption, it is estimated that in 1970, U.S. production of groundfish will be about 170 million pounds and by 1975, it may be around 165 million pounds.

With consumption estimated at 768 million pounds, and taking into account the yearly stock level, this indicates an import level of about 600 million pounds of groundfish in 1975. With the rise in United States consumption, and the slow but continued decline in United States production, 1975 imports of groundfish are expected to increase by approximately 75 per cent over the 1967 level.

Can Canada retain its share of the market? It is difficult to say. Considering the likelihood that the home markets of Canada's European competitors will continue to grow, perhaps the best assumption to make is that Canada will retain its share of the United States market. There is no likelihood that European markets for Canadian fresh and frozen groundfish will increase over this period.

Canada's domestic market is expected to grow by 20 per cent by 1975. This is predicated on population increase only; it is assumed that Canadian per-capita groundfish consumption - already much above the United States level - will not change appreciably during the next decade.

The combined effect of these assumptions on the projected growth of markets for Canadian groundfish is shown in Table 2-5.

TABLE 2-5

Markets for Canadian Groundfish, 1967 and 1975

Market	Product Weight	
	1967	1975 (est.)
	---- 000,000 lbs. ----	
Canada	110	130
United States	205	360
Europe	10	10
Total	325	500

One further adjustment is necessary to arrive at a projection of marketings in 1975. The market for salt cod is declining, and about one-third of all cod landed in the Atlantic Region is salted. In 1967, cod made up 47.4 per cent of all groundfish landings. In an average year, then, salt cod accounts for about 15 per cent of all groundfish landings in the region. If the salt cod fishery is assumed to remain relatively stable (that is, to decline by no more than about 20 per cent by 1975), then the total market for groundfish could be expected to increase by about one-half by 1975.

Landings of groundfish in the region amounted to 1,017 million pounds (round fresh weight) in 1967. An increase of the order forecast would require landings of about 1,525 million pounds by 1975. The two critical assumptions in the forecast are that the American market will resume its pre-1967 growth, after having absorbed the impact of the Bishops' Decree, and that Canada will be able to maintain its pre-1967 share of the American market in competition with European producers.

Marketing of Groundfish

The break in the American groundfish market in 1967, discussed previously, came at the end of a period when the Canadian groundfish industry had expanded capacity significantly, with considerable federal and provincial assistance. Conditions of overcapacity and oversupply currently plague the industry, and as has been noted, markets are not expected to recover to their 1966 levels until about 1970. Not until about 1972 would the growth of the market have increased to the point where the full catching capacity added to the fishing fleet up to 1967 would be fully employed. Left to itself this market correction would see the elimination of inefficient plants and vessels well before this time; such elimination is in fact occurring at present.

The current situation provides both a challenge and an opportunity. The challenge is that many plants, which often provide the only source of employment in the community, are being forced to close, with the consequences of unemployment and distress for those who are unable to move, and drastic re-adjustment for those who are mobile. For the inefficient plant, economics provides no answer; it is a social problem - a welfare problem - which calls for support of the people affected. Re-training, mobility assistance and income supports to the individuals and families affected are the indicated therapy.

However, in addition to the basically inefficient plant whose closing has been hastened by the marketing crisis, but whose ultimate fate was clear in any event, there exists the very real possibility that overreaction to the current marketing crisis may well eliminate plants which have potential long-term viability. Because of this, later sections of this report will consider the question of the optimum plant location in the region over the long term, having regard for the nature and distribution of the resource, and the implications for the industry of scale of operation and access to markets.

Because fish markets and marketing are considered to be such a critical area at this time, the Atlantic Development Board has undertaken an intensive examination of marketing. This marketing study will concentrate on the process of marketing, from port landings to the retail level, focused on the United States market for groundfish. More particularly, it will identify the function of each element in the marketing chain; it will identify the services performed by the fish processor, broker, wholesaler, distributor, warehouser, agent, retailer, etc.; and it will attempt to identify the costs incurred in providing each of these services. It is suspected that inefficiencies exist in marketing channels, that fish passes through too many hands between the fisherman and consumer, and that the charges for some services may be exorbitant. Improvement of efficiency and reduction of costs for marketing fish could improve incomes for Canadian fishermen and processors without increasing volumes, or consumer prices. This study is in its early stages, no results are yet available, and further consideration of groundfish marketing problems and potential must await its completion.

Consumption and Marketing of Herring Fishmeal and Oil

Herring fishmeal and oil make up the other critical growth sector requiring market analysis. The Canada Department of Fisheries (1967) estimated that total Canadian landings of herring would expand from 0.85 billion pounds in 1966 to about 1.25 billion in 1968, and to a minimum of 1.5 billion in 1975 (Table 2-6). It is considered possible, if the resource can support it, that the Canadian fishery (Atlantic and Pacific) may double that figure to attain the 3.0-billion-pound level by 1975.

Assuming little change in the utilization of herring for direct human consumption, this implies a minimum incremental expansion in markets for herring fishmeal and oil to utilize an additional 0.65 billion pounds of herring by 1975. The maximum increment, given the upper estimate in Table 2-6, would be 2.15 billion pounds.

For the east coast alone, the Department of Fisheries foresees expansion of fishmeal production by 1970 to utilize a total of 0.8 billion pounds of herring, with 1975 utilization of at least 1.0 billion pounds - perhaps as high as 2.0 billion.

A review of the fishmeal market prepared for the May 1966 herring conference (Mitchell, 1966) provides a basis for estimating future trends in the market for fishmeal and oil. The market for fishmeal is expected to remain strong, particularly to facilitate the expansion of poultry production. It is expected that meatmeal competition will decrease.

Although envisaged expansion of the herring catch to 1.0 billion pounds on the east coast by 1975 will involve 700 million pounds for reduction purposes, yielding 70,000 tons of fishmeal, this is not expected to have any impact on the world market. Based on world fishmeal utilization in 1964 (3.4 million tons), the east coast increment of 70,000 tons represents an addition of only 2 per cent. This compares with an actual increase in utilization of fish for reduction in 1964 of 2 per cent.[1]

In 1966, world production of fishmeal (at 4.2 million tons) was over seven times the 1948 level. Production had more than doubled to 1.36 million tons in the decade to 1957, then doubled again in 5 years to 2.89 million in 1962, and then increased by 45 per cent in four years to the 1966 level. In 1967, it may have reached 4.5 million tons.

The Canadian industry expansion on the east coast came when Peruvian production declined by 0.3 million tons in 1965 and prices shot up. The outlook for the Canadian meal industry depends principally on the outlook for Peruvian production and the behaviour of prices. There are some hopeful signs: some of the Peruvian plants have deteriorated, and there is pressure on their stocks of anchovy. World demand is rising, and the possibility of a Peruvian limit would put a bonus on new production,

Prices could go down one-third from the $190-per-ton level, at which the Atlantic plants entered the field, before the break-even point was reached. In 1967 North American prices indicated that there still appears to be a good margin for domestic and United States marketing in the short run. The long-run future is firmer.

1/ World production of fish for reduction is dominated by Peru, with production of 1.47 million metric tons in 1966, 35 per cent of world output.

TABLE 2-6

Projected Annual Increments in Herring Meal and Oil Production and Marketings, Canada, 1967-1975

Item		1967	1968	1969	1970	1971	1972	1973	1974	1975	Actual 1966	1975 Total
Annual Increment in:												
Herring landings (000 lbs.)	a)*	+200	+200	+ 30	+ 40	+ 30	+ 40	+ 30	+ 40	+ 40		
	b)‡			+200	+200	+200	+200	+200	+250	+250		
Cumulative (1966 base):												
Herring landings (000 lbs.)	a)	200	400	430	470	500	540	570	610	650	850	1,500
	b)	200	400	630	870	1,100	1,340	1,570	1,860	2,150	850	3,000
Annual Increment in:												
Meal (000 tons)	a)	+ 20	+ 20	+ 3	+ 4	+ 3	+ 4	+ 3	+ 4	+ 4		
	b)			+ 20	+ 20	+ 20	+ 20	+ 20	+ 25	+ 25		
Oil (000 gals.)	a)	+1,290	+1,290	+194	+266	+194	+266	+194	+266	+266		
	b)			+1,290	+1,290	+1,290	+1,290	+1,290	+1,613	+1,613		
Cumulative (1966 base):												
Meal# (000 tons)	a)	20	40	43	47	50	54	57	61	65	55	120
	b)			63	87	110	134	157	186	215	55	270
Oil** (000 gals.)	a)	1,290	2,580	2,774	3,040	3,234	3,500	3,694	3,960	4,226	4,800	9,026
	b)	1,290	2,580	4,064	5,620	7,104	9,650	11,134	13,013	14,892	4,800	19,692

* Rows (a) are conservative estimates. ‡ Rows (b) are major development estimates.

\# The minimum market development for fishmeal over 1966 levels of 55,000 tons will be by increments of 3,000-20,000 tons per year, to an additional absorption of 65,000 tons per year in 1975, or a total market of 120,000 tons (or a doubling). Accelerated maximum development will require a build-up of further absorptive capacity by 20 to 25,000 tons per year to an additional absorption of 215,000 tons in 1975 or a total market of 270,000 tons (a quintupling).

** In terms of herring oil, a low oil-yield ratio was used because of east coast expansion. The market will have to expand from 4.8 million gallons to 9 million gallons. A further major expansion on both coasts would require a market for 19.7 million gallons in 1975.

Source: Canada Dept. of Fisheries. Trends in the development of Canadian fisheries. Ottawa. 1967. (Mimeo.)

With meal expansion will come oil expansion. World production reached 732,100 metric tons in 1966, with Norway the leading producer at 170,000 tons, but Peru the leading exporter (139,000 tons). Prices in 1967 were firm to strong. The use of fish oils in poultry feed is strengthening as withdrawal timing is being made precise to avoid fishy flavouring in poultry meat.

3. THE NATURE OF THE RESOURCE

The future catch in those waters normally fished by east coast fishermen will be determined by a number of interrelated factors. Naturally, the foremost factors will be the size of the stock and the quantity of effort employed upon the stocks. The size of the future stocks depends upon the water temperatures, available feed, and market demand as it affects total effort by domestic and foreign fishermen.

Since different stocks of fish have different growth rates, which may vary from 5 per cent of weight annually to as high as 200 per cent (Fisheries Research Board, 1961), an estimate of potential yield is a much more meaningful figure than is a figure representing the size of the stock. However, it is also extremely difficult to estimate future potential in an international fishery - particularly, when one or more nations concentrate on a particular species, which may effectively limit the future potential of the stocks.

In recent years a number of significant studies have been published which deal with the state of Northwest Atlantic stocks. In addition, the International Commission for the Northwest Atlantic Fisheries (ICNAF) has been publishing and reporting on stocks since the early 1950's.

A paper presented to the Fisheries Council of Canada (Templeman, 1966) dealt with the state and potential of the Northwest Atlantic stocks. Dr. Templeman noted that, in 1964, 2.95 million tons of all species were landed from the ICNAF Area. The distribution of species caught, and the Canadian share of species totals, are summarized in Table 3-1. Table 3-2 indicates the ICNAF Subareas in which the catches of various species are dominant. The location of ICNAF Subareas and Divisions is shown in Figure 3-1.

Commenting on the emphasis of Canadian fishing effort, Dr. Templeman stated:

> It is apparent that in any future expansion of the trawler fleet the cod must receive most attention. Except for sporadic attempts, Canadians at present do not fish offshore cod north of the Grand Bank region and in fact there is no significant Canadian catch of offshore cod north of Subarea 4. This means that cod are caught offshore in quantity by Canadians only in Subarea 4 which accounts for only 16 per cent of the total cod catch of the ICNAF Area.

TABLE 3-1

Distribution of Species Landed, and Canadian Share of Catch by Species, Northwest Atlantic Fisheries, 1964

Species	Per Cent of Total Landings	Canadian Landings as Per Cent of Species Total
	%	%
Cod	48	23
Herring	10	47
Silver Hake	10	0
Redfish	7	17
Flatfishes	5	51
Haddock	5	41
Sea Scallops	4	54
Remainder	11	43
Total	100	--

Source: ICNAF statistical bulletin, vol. 14. Dartmouth, Nova Scotia, 1966.

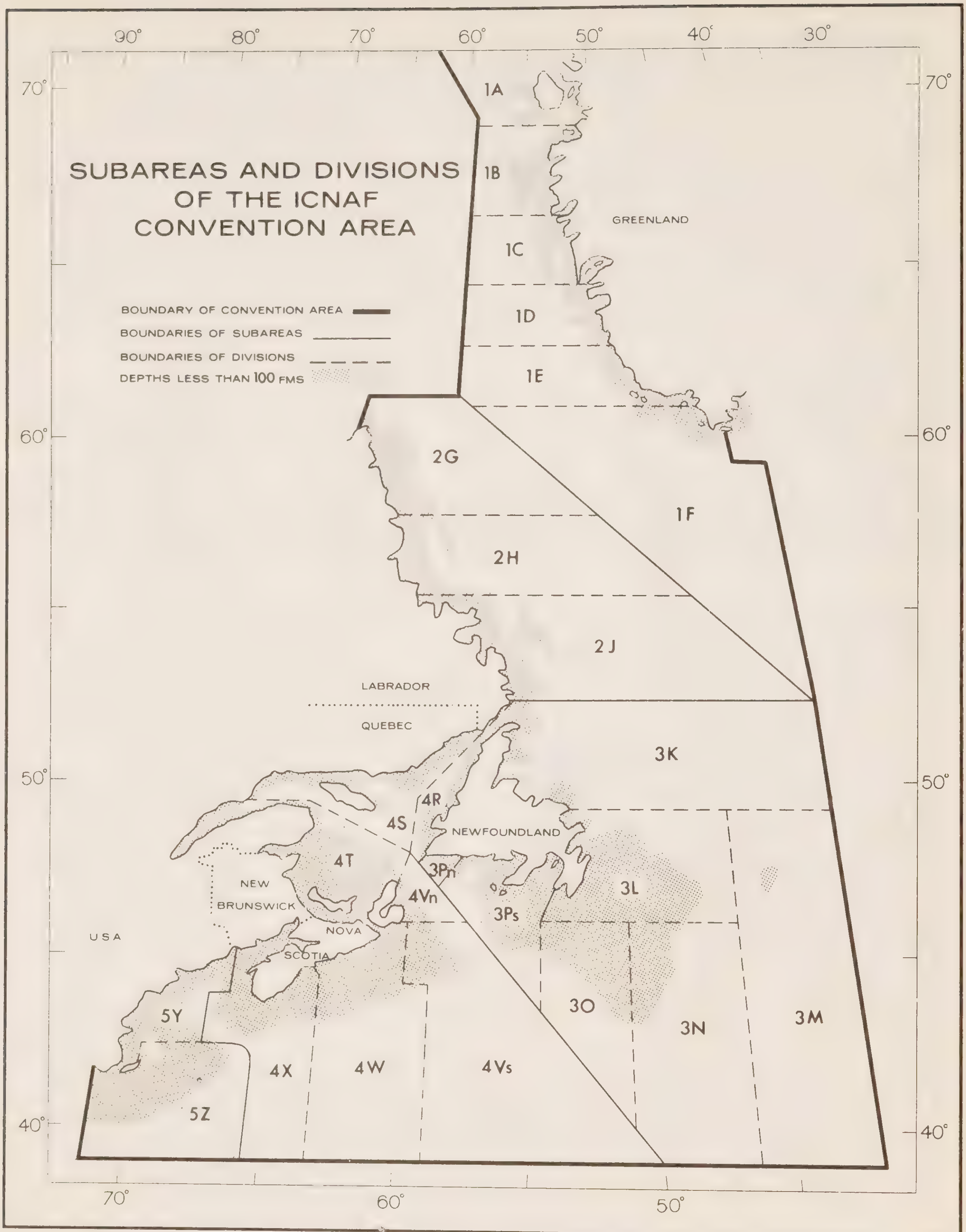
TABLE 3-2

Distribution of Catch by Species and ICNAF Subareas, Northwest Atlantic Fisheries, 1964

Species	Subareas					Total
	1	2	3	4	5	
	%	%	%	%	%	%
Cod	25	15	41	16	3	100
Herring	-	-	1	46	53	100
Silver Hake	-	-	-	27	73	100
Redfish	14	13	44	25	4	100
Flatfishes	2	1	35	24	38	100
Haddock	-	-	9	42	49	100
Sea Scallops	-	-	1	9	90	100

Source: ICNAF statistical bulletin, vol. 14. Dartmouth, Nova Scotia, 1966.

FIGURE 3-1



Reproduced from ICNAF Statistical Bulletin, 1965

For redfish we are fishing only Subarea 4 and the southern fringe of Subarea 3. This is another field for expansion.

We are not yet taking part significantly in the offshore silver hake and herring fisheries. The low prices for these fish offer difficulties for trawler catches. As fish prices rise it may be possible to increase the area fished for flatfishes but we are already taking a great share of these fishes and it may be difficult enough to maintain our present percentage share of the landings. In the Newfoundland area, both inshore and offshore, there are great quantities of capelin which will presumably be used as meal but which like the herring will not attain their full value until they are used as human food. The spiny dogfish and the porbeagle are beginning to be used. More squid could be caught in the years of abundance if the additional amounts could be marketed profitably.

There are other fishes, not discussed here, which have become more important in the catches in recent years - pollock mainly in Subarea 4 and white and red hake chiefly in Subarea 5 and many minor species are contributing to the landings in increasing amounts instead of being thrown overboard. The ultimate aim must be to use all fish and as far as possible invertebrates for human food and otherwise for fishmeal.

Inshore since 1952, Canadian lobster landings have varied between 19,000 and 24,000 tons. Landings have declined since 1960, and the 1964 landings were 4,000 tons below the 23,000 tons caught in 1960. At least in the colder parts of the lobster area, both short- and long-term lobster landings are likely to be unfavourably affected by lower temperatures, and sea temperatures in the Maritime and Newfoundland areas have been falling on the average since the early 1950's.

Some of the coastal molluscan resources have suffered greatly, from disease in the oyster and presumably from over-exploitation in the clam.

Total landings of sea scallops from Georges Bank (Division 5Z) reached a peak of 15,000 tons of shucked meats in 1962 and fell to 12,000 tons in 1964 in spite of increasing effort. Canadian landings from this bank have increased steadily from 1.6 per cent of total landings in 1955 to 48 per cent in 1964. In this year, 90 per cent of the Canadian offshore scallop landings came from

Georges Bank. Year-class success is important for scallops and difficult to estimate at early ages because very small scallops cannot be caught efficiently. Long-term prediction of fishing success is therefore difficult.

The fishery for Atlantic salmon has recovered a little in recent years but the effects on the Canadian landings of the large new salmon fishery in West Greenland are yet to be assessed.

Swordfish landings increased with the introduction of the longline method of fishing but showed a decline in 1965.

The coastal herring fishery is showing new life with the higher prices for fishmeal and the successful purse-seining ventures off southern Newfoundland, the Gulf of St. Lawrence and southwestern Nova Scotia. There can be no assurance, at least in the Newfoundland area, that large herring populations will always be present in any single area. The history of the Newfoundland fishery shows great fluctuations in area abundance of herring with rapid disappearances and appearances of large local populations. The assessment of the effects of nature and of the fishery on these herring stocks will be a major field of research matching the importance of the industry.

The great inshore cod fisheries of Newfoundland are showing the effects of the increasing offshore fishery, particularly that of winter and spring on the cod spawning schools. These effects are showing up in the reduction in fish size and in catch per man and, especially on the northeast coast of Newfoundland, in the reduction of the overall total inshore catch in spite of increases in men and gear.

The general outlook for major expansion of the offshore fishery can be one of pessimism or optimism, with the balance between these two attitudes dependent on Canadian ability to compete with high efficiency in the offshore fisheries.

It may be significant that the fields where North Americans dominate, such as the flatfishes and scallops, are those where the catch per hour's fishing is relatively low. In the international fisheries, Canada will need to decide whether its interest lies in the maintenance of larger or smaller standing stocks or of larger or smaller fish in these areas. (Templeman, 1966.)

In 1963, Dr. W. R. Martin of the Fisheries Research Board presented a forecast of general fisheries trends based upon past trends, foreign fishing and fish surveys. Most of Dr. Martin's forecast is still pertinent to today's conditions. Some of the trends anticipated at that time were as follows:

1) The number of species landed will increase. Some of these will be tunas, skates, silver hake (whiting), argentines, and mussels.

2) There will be greater utilization of small fish now discarded at sea. Discards of flounder, and sometimes cod and haddock, will be reduced as markets develop for small fish.

3) We will see increased exploitation of stocks, particularly offshore, but also inshore. Although some inshore resources still offer possibilities for increased exploitation, the major developments are expected to be on underdeveloped offshore resources such as herring.

4) More intensive fishing by international fleets will reduce abundance and sizes of exploited species. The abundance of larger animals can be expected to decrease, on the average. Fluctuations will continue to result from variations in year-class strength and distribution. Fish sizes will continue to decrease because of a gradual lowering of cull sizes for landing and because of the reduced numbers of large fish resulting from heavier fishing. The increasing use of otter trawlers contributes to reduced abundance and smaller sizes of fish, as well as to increased quantities and variety in landings.

5) There will be greater use of improved fishing gear, equipment, and vessels. Small-mesh otter trawlers will be required to catch some of the small species as they are needed. More efficient towed nets, mechanized gear and fish handling at sea, improved fish-detection equipment, larger stern trawlers, offshore longliner Danish seiners, and different types of purse seiners are expected. (Martin, 1963.)

A recent British publication (Great Britain, 1965) examines the present state of the fish stocks normally exploited by the British distant-water fleet. Although the report is primarily based upon the Eastern Atlantic stocks, significant attention is given to the state of the Western Atlantic stocks. The anticipated yield per unit of effort for the main fishing areas in the North Atlantic during the 1965-68 period is well documented. (<u>See</u> Appendix Table A-8.)

The British report states that there is no doubt that the general decline in stock abundance is, in the main, due to fishing pressures. Although the international catch in total is as high as ever, the catch per unit of effort has fallen substantially, with the effect that some fishing units are no longer economic.

The report states further that in some stocks the level of production could actually be improved by reducing the amount of fishing, so that, for the purpose of obtaining the maximum amount of protein for the minimum of fishing effort, there is much to be said for some control of the amount of fishing. The study of the effects of such a control, and of methods whereby it could be successfully introduced, forms one of the most urgent and important tasks of the regulatory commissions, the Northeast Atlantic Fisheries Convention and the International Commission for the Northwest Atlantic Fisheries.

Attempts have been made to estimate the quantity of probable fishing effort by foreign nations on the Northwest Atlantic fishing grounds during the periods 1965-70 and 1970-75. Unfortunately, the results obtained through official channels have not been encouraging because nine of the fourteen nations now fishing in the waters off Canada's east coast were unable to estimate future fishing activity. Information obtained from five nations tends to indicate that the number of vessels fishing the grounds during the 1970-75 period will probably increase by 25 per cent over 1965. It is anticipated that the Canadian fleet of large trawlers will grow more, proportionally, than any of the foreign fleets on the grounds. In fact, the Canadian fleet of large groundfish draggers over 100 feet in length will probably increase from 114 in 1965 to 250 by 1975.

4. ESTIMATES OF LANDINGS, 1975

East coast landings, including a projection by the Department of Fisheries of the 1975 catch (except groundfish) for the whole Atlantic coast, are set out in Table 4-1. To provide estimates for the Atlantic Provinces only, that part of the 1975 catch that will be landed in the Province of Québec must be estimated and deducted from the values in the table.

Of the pelagic and estuarial fishes, Québec in 1965 accounted for 11.4 per cent of the east coast landings of herring and salmon, and 64 per cent of the landings of eels. Of molluscs and crustaceans, Québec accounted for 8 per cent of the east coast landings of lobster and 33 per cent of the landings of clams. By 1975 it is assumed that Québec will maintain its relative position in the landing of herring and salmon, but will have declined in the proportion of eels to perhaps one-third of total landings. These three species constituted 91 per cent of the Québec landed value of pelagic and estuarial fishes in 1965.

The effects of these assumptions about the Québec fishery are summarized in Table 4-2 which forecasts landings and values for the Atlantic Provinces in 1975. Included in the table is an estimate of total groundfish landings, which were estimated separately.1/

1/ See Chapter 2. It is assumed here that groundfish landings will correspond to the forecast 1975 marketing level of 1,525 million pounds.

TABLE 4-1

Landings by Species (except Groundfish), East Coast of Canada, 1965, 1966 and 1975

Species	Volume			Value		
	1965	1966	1975	1965	1966	1975*
	-- 000,000 lbs. --			---- $ 000,000 ----		
Pelagic and Estuarial						
Herring	405	551	1,000 (+1,000)‡	4.25	6.22	11.0 (+11)
Mackerel	25	26	100	0.82	0.90	3.0
Alewives	12	8	10	0.21	0.15	0.2
Capelin	11	11	100	0.09	0.09	0.8
Swordfish	8	7	10	3.25	2.98	4.0
Salmon	5	5	5	2.22	2.67	3.0
Smelts	4	4	4	0.30	0.35	0.4
Eels	1	1	3	0.30	0.27	1.0
Other (incl. tuna)	3	3	20+	0.22	0.14	1.0+
Total	475	616	1,252 (+1,000)	11.66	13.76	24.4+ (+11)
Molluscs and Crustaceans						
Lobster	41	37	40	26.64	20.83	23.0
Scallops	20	18	25	10.85	7.45	10.0
Squid	18	11	25	0.28	0.22	0.5
Oysters	4	4	6	0.53	0.56	0.8
Clams	3	4	4	0.19	0.26	0.3
Other (incl. mussels)	2	2	10	0.08	0.09	0.5
Total	86	76	110	38.56	29.41	35.1+
Viscera, Tongues and Scales	21	21	30	0.39	0.45	0.7
Marine Plants	54	66	200	0.66	1.16	3.0
Marine Mammals	-	-	-	1.90	2.21	3.0

* 1966 dollars.

‡ An alternative estimate for herring is bracketed as a possible further increase (as discussed in Chapter 2).

Source: Canada Dept. of Fisheries. Trends in the development of Canadian fisheries. Ottawa, 1967. (Mimeo.)

TABLE 4-2

Estimate of Landings, Atlantic Provinces, 1975

Species	Landings	Value*
	000,000 lbs.	$ 000,000
Groundfish	1,525.0‡	60.8
Pelagic and Estuarial	1,143.5	23.2
Herring	900.0	10.0
Salmon	4.5	2.7
Eels	2.0	0.7
Other	237.0	9.8
Molluscs and Crustaceans	103.8	33.4
Lobster	36.8	21.8
Clams	3.0	0.2
Other	64.0	11.4

* 1966 dollars.

‡ 1975 market forecast. See Chapter 2.

Source: Derived from Table 4-1.

5. INSHORE FISHERIES

Although records concerning the number of fishermen engaged in the primary industry are available for many years it is only for the most recent years that any statistics measuring length of employment in the industry are available. From the normal statistical series it appears that at the present time there are fewer than 5,000 full-time fishermen in the Maritimes, about 9,300 part-time fishermen and about 9,500 occasional. (See Appendix Table A-6.) In Newfoundland, 21,700 men were employed in the fishery in 1965. If the same basis of statistical collection were used in Newfoundland as in the Maritimes approximately 1,000 of these Newfoundlanders would be considered as full-time while 17,700 would be classified as part-time and 3,000 as occasional.

The quantity and value of the inshore catch landed annually by fishermen in the Atlantic Region is not available from official statistical series. However, approximations can be obtained since some species are normally landed only by inshore fishermen, and the quantities landed by vessels over 25 gross tons are known.[1/] In the Maritime Provinces it is estimated that the inshore fishermen catch approximately 500 million pounds of all species, valued at about $36 million. The average value of catch per inshore fisherman would therefore be of the nature of $1,930 in the Maritimes. In Newfoundland the inshore catch approximates 425 million pounds per year with each fisherman earning approximately $800 per season. In Newfoundland the bulk of the inshore catch consists of groundfish, while in the Maritimes, although the bulk of the quantity is accounted for by herring,[2/] the high value of catch is due to the species mix which contains a high proportion of luxury and semi-luxury items, mainly lobster.

For statistical purposes the number of fishermen engaged in the inshore fishery and offshore fishery have not normally been broken down for the Maritime Provinces. In Newfoundland a breakdown is available based upon the numbers fishing on craft under and over 25 gross tons. If vessels of over 25 gross tons are classified as offshore, it is evident that during 1965 there were 970 offshore fishermen in Newfoundland and 20,731 inshore fishermen. In the Maritime Provinces an estimate of similar figures would indicate that in 1965 there were 3,600 offshore fishermen and 20,100 inshore fishermen.

1/ Landings by vessels over 25 gross tons are published annually in the ICNAF statistical bulletin.

2/ File information, Economics Branch, Canada Department of Fisheries.

Appendix Table A-5 contains statistics concerning the number of fishermen in each of the Maritime Provinces since the early 1920's. Unfortunately, comparable annual data are not available for Newfoundland, although it is estimated that the number of Newfoundland fishermen exceeded 40,000 in 1920. In Nova Scotia and New Brunswick the number of fishermen has decreased during the past 30 years. Despite sketchy statistical evidence it seems certain that the entire decrease has been in the inshore sector since the deep-sea sector has been developing during that time. It is anticipated that the downward trend in numbers of inshore fishermen will continue. Prince Edward Island shows a modest increase in the numbers of fishermen over the period 1923-65, probably due to the ease of entry into the lobster fishery. In Newfoundland, the total number of fishermen increased from 1954 to 1965, due primarily to lack of alternative employment opportunities. However, in both provinces it is anticipated that inshore activity will decline in the future as the deep-sea fishery is expanded.

Certain relatively valuable species will probably remain as the preserve of the Atlantic coast inshore fisherman. In particular, certain of the scallop beds lying beside the coast, oysters, clams and lobsters, as well as the estuarial fishes, will maintain a core of inshore fishermen. However, for the groundfish species and certain of the pelagic species (herring and swordfish) the proportion (in quantity and value) captured annually by the inshore fisherman will probably decline since the offshore fishery is increasing rapidly.

In considering the inshore fishery in greater detail there is a division in emphasis between Newfoundland, where cod is the mainstay, and the Maritime Provinces, where the lobster is most important economically.

Newfoundland: The Cod Fishery

Although the number engaged in the inshore fishery in Newfoundland increased by about 40 per cent from 1956 to 1965, the landings per man-year decreased by approximately 44 per cent. (See Table 5-1.) The absolute total inshore cod catch declined from 200,000 metric tons in 1955 to 157,000 metric tons in 1965, in spite of the increased numbers of men and gear added to the inshore fishery.

TABLE 5-1

Volume of Inshore Landings per Man-Year, by ICNAF Division,*
Newfoundland, 1956-1965

Year	West Coast 4R	Labrador 2G+2H+2J	Northeast Coast 3K	East Coast 3L	South Coast 3Ps+3Pn	Total
	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.
1956	53,220	122,350	59,510	108,160	34,470	67,660
1957	64,560	103,520	52,300	71,100	31,380	55,090
1958	48,190	72,540	25,360	55,010	26,590	38,350
1959	47,290	105,260	38,240	70,160	33,830	49,470
1960	34,600	79,740	34,690	76,560	39,810	49,690
1961	33,740	79,920	24,510	62,960	40,940	42,910
1962	44,450	92,430	33,020	58,490	33,670	45,870
1963	45,150	80,810	35,220	57,800	32,240	44,700
1964	36,820	50,020	28,570	58,340	26,660	38,870
1965	36,850	53,660	23,990	51,000	34,360	38,100

* For location of ICNAF Divisions (e.g., 4R) see Figure 3-1.

Source: ICNAF statistical bulletins; data compiled by Prof. E.D. Day, Memorial University.

The only favourable aspect of the inshore fisheries has been the rapid increase in the value of the catch. This increase is evident in Table 5-2.

TABLE 5-2

Value of Inshore Landings, Newfoundland, 1957 and 1965

Species	Year	Landings	Landed Value	Value per lb.
		000,000 lbs.	$ 000	¢
Cod	1957	384.40	8,344.8	2.16
	1965	287.50	11,200.0	3.88
Lobster	1957	4.19	1,139.4	27.20
	1965	3.74	2,281.0	61.10
Salmon	1957	1.96	550.1	28.00
	1965	2.56	1,023.0	39.20

These three species - cod, lobster and salmon - make up the bulk of inshore landings in Newfoundland. The total landed value of the inshore cod, salmon and lobster fisheries amounted to $10.0 million in 1957 and $14.5 million in 1965. In 1957 there were approximately 15,725 inshore fishermen; in 1965 there were 20,730. The return per fisherman from these fisheries, therefore, amounted to about $648 in 1957 and about $700 in 1965.

In addition there has been an increase in the return for processing to salt as is shown in Table 5-3.

TABLE 5-3

Volume and Value of Salt Fish, Newfoundland, 1957 and 1965

Process & Year	Landed Weight of Fish Put to Salt	Landed Value	Value Per lb.	Quantity of Product	Value of Product	Value Added	Value Added Per lb. of Landed Fish
	000 lbs.	$ 000	¢	000 lbs.	$ 000	$ 000	¢
Wet-Salted							
1957	124,013	2,679	2.16	57,148	3,571.8	893.0	0.72
1965	101,306	3,941	3.88	46,090	8,257.0	4,316.0	4.26
Dry-Salted							
1957	164,521	3,367.9	2.16	41,130	5,511.5	1,943.6	1.18
1965	57,315	2,234.4	3.88	14,329	3,711.0	1,476.6	2.57

The spread between the landed value per pound of gutted head-on fish and its value after wet-salting was 0.72¢ in 1957 and 4.26¢ in 1965. The spread between landed value and product price for dry-salted cod was 1.18¢ in 1957 and 2.57¢ in 1965. In 1957, 57 per cent of the landed weight of cod going to salt was dry-salted; in 1965 only 36 per cent was dry-salted. The changing differential between dry-salted and green or wet-salted fish explains the rapidity with which the shift from dry-salting to wet-salting has been made by the inshore fisherman. Since the product recovery per pound of fresh fish dry-salted is about 25 per cent, while the product recovery for fresh fish wet-salted is about 46 per cent, dry-salted prices per pound would have to be 85 per cent greater than wet-salted prices to provide an equivalent return, assum-

ing that the cost of producing the two products is identical.[1/] Inshore fishermen in the past have been urged to produce dry-salted rather than wet-salted fish. However, it has clearly been to their advantage to produce wet-salted fish during this period.

It has been suggested that unemployment insurance has influenced the volume of fish put to salt, since there is an apparent advantage in salting the catch rather than selling fresh. This feature of the scheme is described in the report of the Atlantic Salt Fish Commission (1965: p. 118):

> Fishermen naturally try to maximize their insurance benefits from a given catch. But first the individual must qualify, and this is not difficult, particularly if he salts his catch. To get 15 weeks' contributions he must light-salt 45 quintals which is equivalent to only 20,160 lbs. of fresh fish. This amount could be caught in one week's fishing. By selling fish in the fresh state he would have to catch at least 534 lbs. per week at 2¼¢ per lb. for 15 weeks, a total of only 8,010 lbs. This is less than half the total required to qualify by salting the catch, but the period of fishing is very much longer. Furthermore, if the salted fish is valued at $16 per quintal, the average value of the fishermen's contribution is 66¢ compared with only 20¢ for the fresh fish giving the salted fish producer an advantage of $16 per week in benefits. Looking at it in another way, he would have to sell 2,667 lbs. of fresh fish in each of 15 weeks or a total of 40,000 lbs. to get the same benefit as he would receive from the 45 quintals of salt fish. Thus it is fairly easy to qualify for benefits, but at this level of landings, because of the better chance of catching the larger quantity over the shorter period as well as the advantage in benefits, the system is heavily weighted in favour of salted fish.

Whatever the factors influencing the production of salted fish, and the proportions wet- and dry-salted, returns to the inshore fishermen have increased in recent years. The price increase for salt cod has meant that the additional income generated in the inshore fishery by processing to salt has

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1/ Production costs for wet- and dry-salted fish are not, however, identical. Wet-salted fish requires more salt and less labour; dry-salted fish, less salt and more labour. Factors such as the increasing opportunity cost of labour and the salt rebate from the federal government would also be important influences on the decision to make wet- or dry-salted fish.

risen from $2.7 million to $5.8 million from 1957 to 1965, an increase from $175 to $280 per fisherman.

Thus despite the general reduction in inshore landings, the decline in the volume of fish put to salt, the stability in the volume of landings of lobster and the rapidly increasing number of fishermen entering the inshore fishery, average cash receipts in current dollars in the inshore fishery have increased substantially over the decade.

The Lobster Fishery

The inshore fisheries of the Maritime Provinces are dominated by the lobster fishery. Of the estimated 20,100 inshore fishermen in the three Maritime Provinces in 1965, 18,075 - 90 per cent - were engaged in lobster fishing for at least part of the year. Given this dominant position, the solution to the problems of the lobster fishery is the key to the improvement of the inshore fisheries generally.

As will be noted in Table 5-4 the number of individuals participating in the lobster fishery has tended to increase over the past 35 years. In fact, the number of participants in the fishery reached record numbers in all provinces except Nova Scotia during 1965.

TABLE 5-4

Number of Lobster Fishermen, Atlantic Provinces, Selected Years, 1930-1965

Year	Nfld.	N.S.	P.E.I.	N.B.	Total	Total Excluding Newfoundland
1930	-	8,559	1,989	3,130	-	13,678
1935	-	10,424	2,726	4,060	-	17,210
1940	-	9,427	2,001	3,448	-	14,876
1945	-	7,559	1,939	3,258	-	12,756
1950	-	10,483	2,313	3,596	-	16,392
1955	-	10,924	2,380	3,833	-	17,137
1960	5,594	9,815	2,659	4,095	22,163	16,569
1961	6,358	9,473	2,810	4,204	22,845	16,487
1962	6,583	9,527	2,792	4,289	23,191	16,608
1963	7,284	10,031	2,798	4,144	24,257	16,973
1964	8,090	10,085	2,809	4,087	25,071	16,981
1965	8,441	10,739	3,043	4,293	26,516	18,075

Source: Economics Branch, Canada Dept. of Fisheries.

The reasons for the increased participation in the fishery are not entirely clear at the present time. Some individuals may have returned to the fishery to ensure future participation if entry is restricted to those who were recently involved in the industry. Others may have been attracted to the fishery by the relatively high unit price paid in recent years as well as the ease with which credit can be obtained from buyers.

In recent years the total lobster catch in the four Atlantic Provinces has tended to decline (Table 5-5).

TABLE 5-5

Lobster Landings, Atlantic Provinces, 1956-1965

Year	Nfld.	N.S.	P.E.I.	N.B.	Total
	-------------------		000 lbs.	-------------------	
1956	4,824	22,250	9,701	11,542	48,307
1957	4,197	18,169	8,354	10,450	41,170
1958	4,697	17,932	7,969	9,663	40,261
1959	3,746	21,061	8,396	9,333	42,536
1960	4,508	19,939	10,138	11,913	46,495
1961	3,921	19,828	9,511	10,873	44,133
1962	4,154	20,004	8,711	9,355	42,224
1963	4,494	20,224	7,376	8,450	40,544
1964	4,510	19,113	7,824	7,260	38,707
1965	3,738	18,536	8,838	6,113	37,225
Av. 1956-60	4,394	19,870	8,912	10,578	43,754
Av. 1961-65	4,163	19,541	8,452	8,410	40,566

Source: Fisheries Statistics of Canada. D.B.S.

In Prince Edward Island the fishery is, by and large, a lobster fishery. In 1957 lobster made up 69 per cent of the landed value of all fishery products; in 1965 lobster accounted for 73 per cent of the landed value. In 1965, 3,043 of the 3,566 fishermen on the Island fished lobster for all or part of the season.

As shown in Table 5-6, landed value per fisherman in Prince Edward Island has been increasing rapidly.

Lobster landings have remained essentially stable during this period; however, the price per pound has increased substantially (Table 5-7). Between 1961 and 1965 the price of lobster increased approximately 81.5 per cent.

TABLE 5-6

Landed Value of All Fish Per Fisherman, Prince Edward Island, Selected Years

Year	Fishermen	Landed Value	Value Per Fisherman
	no.	$ 000	$
1957	3,000	3,548.8	1,180
1961	3,464	4,489.1	1,290
1965	3,566	7,083.0	1,980

Source: Fisheries Statistics of Canada. D.B.S.

TABLE 5-7

Landed Value of Lobster, Prince Edward Island, Selected Years

Year	Catch	Landed Value	Value Per lb.
	000 lbs.	$ 000	¢
1957	8,534	2,456.2	28.8
1961	9,511	3,055.0	32.1
1965	8,838	5,177.0	58.2

Source: Fisheries Statistics of Canada. D.B.S.

In Nova Scotia and New Brunswick the lobster fishery is also the dominant component of the inshore fishery. In 1965, of the 11,330 men in the inshore fishery in Nova Scotia, 10,739 were lobster fishermen for part of the season. In New Brunswick, of approximately 5,300 inshore fishermen, 4,293 were lobster fishermen.

It is clear, since the inshore fishery in all of the Maritime Provinces is predominantly a lobster fishery, that an understanding of the lobster fishery is essential to any attempt to diagnose the problems and directions that the inshore fisheries in these provinces should take. A study of the lobster fishery has recently been completed by the Fisheries Research Board of Canada (Rutherford, Wilder and Frick, 1967), and this report forms the basis of most of the comments which follow.

Only in Southern New Brunswick, South Shore Nova Scotia and Newfoundland does lobster represent less than half of total receipts from fisheries. Table 5-8, adapted from the Fisheries Research Board report, shows the variation in dependence on the lobster fishery for fisheries income in a number of different areas in the region.

TABLE 5-8

Net Income From All Sources Per Enterprise Operator in the Lobster Fishery, 1961

Sample Area	Unit	(1) Net Return From Lobster Fishery	(2) Net Receipts From Other Fisheries	(3) Depreciation and Interest	(4) Net fishery Income (Net of Depreciation and Interest) (1)+(2)-(3)	(5) Forestry and Agriculture Income	(6) Labour Income	(7) Other Incomes	(8) Transfer Payments	(9) Unemployment Insurance	(10) Total Income
Southern N.B.	$	855	948	352	1,451	24	241	151	77	286	2,230
	%				65.1	1.1	10.8	6.8	3.4	12.8	100
Western N.S.	$	941	678	244	1,375	40	328	91	112	161	2,117
	%				65.4	1.9	15.5	4.3	5.3	7.6	100
South Shore N.S.	$	336	609	100	845	56	312	13	195	251	1,672
	%				50.5	3.3	18.7	0.8	11.7	15.0	100
Eastern N.S.	$	513	261	137	637	45	368	55	134	236	1,476
	%				43.2	3.1	24.9	3.7	9.1	16.0	100
Gulf of St. Lawrence	$	1,276	131	167	1,240	166	532	68	155	273	2,441
	%				51.1	6.8	21.8	2.8	6.3	11.2	100
Western Northumberland Strait	$	1,442	159	219	1,382	169	298	77	280	304	2,515
	%				55.2	6.7	11.8	3.1	11.1	12.1	100
Newfoundland	$	247	454	116	584	81	187	2	274	261	1,389
	%				42.1	5.8	13.5	0.1	19.7	18.8	100
All Areas	$	827	389	181	1,035	59	325	60	210	257	1,950
	%				53.0	3.0	16.6	3.1	10.8	13.2	100

Source: Rutherford, J.B., D.G. Wilder and H.C. Frick. An economic appraisal of the Canadian lobster fishery. Bulletin 157. Fisheries Research Board of Canada. Ottawa, Queen's Printer, 1967.

The table also illustrates a number of other important characteristics of the inshore fishery. The data should be seen against the background of personal income per labour force member, shown below for Canada and the Atlantic Provinces for 1961:

Canada	$ 4,374
Newfoundland	3,787
Nova Scotia	3,753
Prince Edward Island	2,970
New Brunswick	3,347

Income of lobster fishermen in Western Nova Scotia, which had the highest total income from the lobster fishery, reached only 57 per cent of the provincial average and 50 per cent of the Canadian average. In Southern New Brunswick the lobster fisheries income was 67 per cent of the provincial average and 51 per cent of Canada. The worst situation was in Newfoundland where income in the lobster fishery was 37 per cent of the provincial average, and 32 per cent of the Canadian. In Prince Edward Island, which had the best experience, the Northumberland Strait fisherman's income was 85 per cent of the provincial average, and 58 per cent of the Canadian average.

It is also of interest to note the relative unimportance of the supplements to fisheries income from forestry and agriculture. Only in the Gulf and Northumberland Strait areas (which includes Prince Edward Island) does the income from forestry and agriculture assume any importance, and here less than 7 per cent of total income is obtained from these occupations.

One significant factor is the dependence on transfer payments and unemployment insurance to maintain even the low level of incomes in the inshore fishery. Over-all, 24 per cent of the total income in the inshore fishery is from these two sources, ranging from a low of 12.9 per cent in Western Nova Scotia (where the lobster season of December 1 to May 31 coincides with the eligible benefit period for fishermen's unemployment insurance payments), to a high of 38.5 per cent of total income of inshore fishermen in Newfoundland from these two sources of governmental payments.

This analysis of lobster fishermen is even more disturbing when it is considered that the survey attempted to cover only "commercial" lobster eterprises - those fishing more than 30 traps in the Maritimes and more than 10 traps in Newfoundland. The universe on which the sample is based considered only 10,266 of the 16,273 lobster enterprises on the Atlantic coast, and covered 18,100 men of the total of 23,963 Atlantic coast lobster fishermen. It is certain that if these additional small-scale lobster fishermen were included in the sample the average fisheries incomes would be even lower.

It is clear that the inshore fishery throughout the Atlantic Provinces is an instrument of poverty. Far too many men,

boats and equipment are being applied to a basically limited resource. Table 5-9, reproduced from the lobster fishery report, provides an interesting insight on this problem. If the apparent economic yield of $62,000 is divided among the existing 10,266 lobster enterprises, the result shows a net yield per enterprise of $6, after deducting an assumed wage of about $660 per year ($30 a week for a 22-week season) and a return on investment of 6 per cent.

If only 7,000 enterprises with 226-300 traps (which was the number of enterprises that the resource could support at this scale of operation and landings) were operating, net yield per enterprise would have been $347.

The data relating to the hypothetical 7,000 enterprises assumes that all of the lobster caught were taken by a more efficiently scaled operation (226-300 traps) though not the optimum size for all locations, since the largest enterprises (those with more than 300 traps) are only possible where bottom conditions are favourable. Under these conditions the net economic yield would be about 40 times as great with the larger average size of enterprises as with the existing size distribution of the 10,266 commercial lobster enterprises. The model developed in the table suggests that if the size of enterprise were expanded to 226-300 traps, there would be room for about 7,000 lobster enterprises instead of the 16,000 that actually existed, and employment for about 12,000 men rather than the 24,000 actually employed in the industry.

Since 1961 total landings of lobster have declined. In 1965 only 37.2 million pounds were landed in the region. However, the price per pound has increased substantially, to an average of about 66¢, and a total landed value of $24.8 million. Fishing costs have probably not increased as rapidly as have returns. The non-farm products component of the general wholesale index, which may be taken as a rough indicator of the increase in fishing costs, increased by only 18 per cent from 1961 to 1965, while the landed value of lobsters per pound increased by just over 100 per cent. The effect on increased return can be seen in Table 5-10, a crude revision to the 1961 table. If the net economic yield of $4.4 million is divided among the 10,266 enterprises, the share per enterprise is $432 per year, which represents an increase of $426 in annual income compared to 1961, over and above wages and return on investment. If numbers were reduced to 7,000, the net yield would be $904.

The increased return for lobster fishing has probably been instrumental in retaining surplus enterprises in the fishery, and in increasing the number of fishermen in areas such as Prince Edward Island where lobster accounts for the bulk of fisheries revenue. In the future it is unlikely that the landed volume of lobsters will increase. Landed values will probably continue to advance, though probably not at the rate that they have in the recent past.

TABLE 5-9

Hypothetical Fishing Costs and Net Yield of the Canadian Lobster Catch of 1961, Based on Cost and Production Data for Two Enterprise Groups*

Particulars	Unit	Sample of 106 Enterprises Fishing 226-300 traps	Total Sample of 506 Enterprises
		7,000 hypothetical enterprises	10,266 existing enterprises
1. Av. per enterprise:			
Landings	lb.	6,834	4,447
Capital stock	$	2,395	1,701
Total costs	$	2,246	1,683
Variable costs	$	1,732	1,253
Fixed costs	$	514	430
2. Av. per lb. of lobsters landed:			
Capital stock	¢	35.05	38.25
Total costs	¢	32.86	37.84
Variable costs	¢	25.34	28.17
Fixed costs	¢	7.52	9.67
3. Gross catch value in 1961	$ 000	18,054	18,054
4. Total costs, computed for 1961 catch of 47,547,000 lbs. of lobsters	$ 000	15,624	17,992
5. Apparent net economic yield (3-4)	$ 000	2,430	62
6. Net yield per enterprise	$	347	6

* Costs were computed for the whole sample of 506 enterprises,and for the group of 106 enterprises fishing 226-300 traps. Variable costs include current expenses and an assumed "wage" of $30 a week to the operator; fixed costs include interest on capital at 6 per cent, and depreciation (on reducing balance basis) at rate of 7½ per cent on shore equipment, 17½ per cent on boats and engines, and 15 per cent on gear and truck or automobiles used in the fishery.

Source: Rutherford, Wilder and Frick (1967).

TABLE 5-10

Hypothetical Fishing Costs and Net Yield, 1965

Particulars	Unit	7,000 Enterprises 226-300 Traps	10,266 Enterprises
Landings per enterprise	lbs.	5,300	3,620
Total costs* per enterprise	$	2,651	1,987
Gross catch value 1965	$ 000	24,831	24,831
Total costs	$ 000	18,600	20,400
Net economic yield	$ 000	6,231	4,431
Net yield per enterprise	$	904	432

* Total costs are assumed to have increased by 18.1 per cent in line with the advance in the non-farm products component of the general wholesale index.

Other inshore fisheries contribute a varying amount to the incomes of lobster fishermen, from just over $1.80 for each dollar obtained from lobsters in the South Shore of Nova Scotia and Newfoundland, to $0.11 per dollar of lobster landed in the Northumberland Strait.

However, no other inshore fishery is capable of being expanded sufficiently to increase the incomes of inshore fishermen. Such species as oysters, salmon and clams are close to the sustainable yield, barring a major technological breakthrough. Groundfish in general are being subjected to increasing pressure offshore and no substantial increase in the inshore catch seems possible. The boats and gear necessary to catch species which seem likely to have a potential for increased yields, such as crab, shrimp and herring, are larger than the normal lobster boat and constructed to different principles, for example with large-capacity holds. Lobster fishermen could not therefore move directly into these fisheries to provide income supplements.

For the Maritime inshore fishery the objective of a reduction in the number of lobster enterprises by half can be considered an essential target for 1975 if enterprise incomes are to be improved. The effect of this reduction on incomes is indicated in Table 5-11. It should be noted that even a reduction in numbers of this magnitude does not result in landings per man which will yield high incomes in the inshore fishery.

TABLE 5-11

Estimated Landings Per Man in the Inshore Fishery, Maritime Provinces, 1965 and 1975*

Province	1965		1975	
	Men	Value of Ldgs. Per Man	Men	Value of Ldgs. Per Man‡
	no.	$	no.	$
N.S.	11,300	2,100	6,500	3,700
N.B.	5,300	1,700	3,100	2,900
P.E.I.	3,500	1,700	2,000	2,900

* Assuming a 50-per-cent reduction in lobster enterprises.

‡ In 1965 dollars.

In Newfoundland, if the objective were established of average landed values equivalent to those in New Brunswick and Prince Edward Island, even more substantial reductions in inshore fisheries manpower would be required. If it were to meet these income objectives, the Newfoundland inshore fishery would support about 5,750 men. For the region as a whole, the number of inshore fishermen would be down from 40,800 in 1965 to about 17,500 in 1975.

Herring Fishery

Although long-established, the herring fishery had been declining until recent years. Now the fishery is expanding as a result of utilization of herring for fish-reduction purposes. Forecasts of its expansion range from about 400,000 metric tons to 800,000 metric tons in 1975.

Since the productivity in this fishery is high (about 350 metric tons per man on a herring seiner), the employment effect of expansion of this order would vary from about 1,200 to 2,400 men. Average landed value of catch per man at 1965 prices would be about $8,100. This is a mobile fishery often engaging for part of the year on stocks off Western Nova Scotia and the Bay of Fundy and then moving to the Newfoundland coast.

A rough guess at future distribution of landings might assign 60 per cent to Nova Scotia and Southern New Brunswick, 25 per cent to Newfoundland and 15 per cent to Prince Edward Is-

land and the Gulf Coast of New Brunswick.1/

"Intermediate" Type Fisheries

There are two fisheries in Nova Scotia which share some characteristics of both the inshore and offshore fisheries. These are the scallop and swordfish fisheries. In common with the inshore fisheries, swordfish vessels are usually fisherman-owned and have relatively small crews. As in the offshore fishery, both scallop and swordfish vessles fish in distant waters and are absent from port for extended periods. The swordfishery is often combined for part of the year with groundfishing; but scallop dragging, because of the gear employed, is usually engaged in exclusively. Both bring a relatively high landed return per man; about $11,000 in the scallop fishery and about $3,500 in swordfishing in 1965. The resource is being fully prosecuted at the present time and little expansion is forecast in either fishery.

There are hopeful prospects for the development of other intermediate fisheries, those that require vessels larger than the traditional lobster boat, but do not require the large otter trawlers used to prosecute the groundfishery. The crab fishery in the Gulf has been particularly dynamic in the last three years. Shrimp resources are being exploited in the Fundy area, and have been identified off the west coast of Newfoundland. Development of these fisheries is too recent to have produced meaningful statistics on average returns to fishermen, but early experience, as is characteristic in a virgin fishery, is very promising.

There are undoubtedly other resources that are not now being exploited that will be prosecuted in the future, such as bar clams off Prince Edward Island, and fat herring in the Gulf. The successful exploitation of these species requires a flexible fishing vessel, large enough to be adapted to a variety of gear, but not as specialized as the large otter trawler. Smaller draggers can often be adapted for these fisheries, and to that extent they can be considered as an extension of the offshore fishery. They are not feasible alternatives for inshore fishermen and their existing vessels.

1/ Based on estimates prepared by Professor E.D. Day in a report on the Newfoundland Fisheries and existing distribution of plants, vessels and catch.

6. THE OFFSHORE FISHERY

The offshore fishery in the Atlantic Provinces is conducted by men operating vessels on the near and far offshore banks. For statistical purposes offshore vessels have been defined as those which have a gross tonnage of 25 tons or more. These vessels normally make fishing trips which are of three to twelve days' duration.

The Atlantic coast offshore fleet grew from 425 vessels in 1955 to 650 in 1965. During this period, the total gross tonnage of the offshore fleet also grew, proportionally more than the increase in numbers. The number of large otter trawlers (over 100 feet) increased from 31 to 130. The distribution of the offshore fishing fleet by tonnage and by province during the years 1962 and 1965 is noted in Table 6-1. The over-all growth in the number of vessels in the fleet has been almost entirely restricted to Newfoundland and Nova Scotia. Also the average size of vessels in the fleet is increasing.

TABLE 6-1

Number of Offshore Fishing Craft, by Tonnage, by Province, 1962 and 1965

Tonnage	Nfld.		N.S.		N.B.		P.E.I.		Total	
	1962	1965	1962	1965	1962	1965	1962	1965	1962	1965
25-49.9	35	41	114	124	133	122	4	2	286	289
50-99.9	13	23	84	89	31	34	12	13	140	159
100-149.9	2	-	20	32	-	6	-	-	22	38
Over 150	29	65*	57	91	-	6	-	3	86	165
Total	79	129	275	336	164	168	16	18	534	651

* Refers to craft over 100 tons.

Source: Fisheries Statistics of Canada, 1962, 1965. D.B.S.

Statistics concerning the number of offshore fishermen and the extent of their employment and earnings are not available and must be estimated. By estimating the number of men employed on each type or size of fishing craft it appears that during 1965 the total number of offshore fishermen approximated 4,600 in the four Atlantic Provinces. They were distributed as follows: Newfoundland, 970; Nova Scotia, 2,725; New Brunswick, 800; and Prince Edward Island, 100.

In total it is estimated that the 4,600 offshore fishermen in the Atlantic Provinces landed fish valued at $35 million during 1964 - an average of $7,300 per fisherman. On a provincial basis the average landed value per offshore fisherman varies from the regional pattern. In Newfoundland, the offshore fisherman in 1965 was responsible for landing fish valued at about $7,600 per man while the inshore fisherman averaged $810. In Nova Scotia the offshore fisherman caught fish valued at $9,000 and the inshore, about $2,100. In New Brunswick and Prince Edward Island, where offshore fishermen are usually involved in the fishery for less than the entire year, each offshore fisherman in 1965 was responsible for landing fish valued at about $3,200 while the inshore fisherman averaged about $1,700.

The future development of the primary fishery will probably take the form of emphasis on the offshore fishery with increased effort on those species now underutilized. As the offshore fleet grows and prosecutes the stocks it is expected that the inshore groundfish stocks will diminish, causing further excess of manpower in the inshore fishery. Certainly as the trawler fleet expands it will draw upon the manpower reserves in the inshore fishery for some of its crews. However, the total number of men required to operate an offshore fleet even three or four times the size of the present fleet is relatively small in terms of the total number of fishermen available.

The bulk of the offshore fishery is a groundfish fishery, prosecuted by large otter trawlers.

Landings of groundfish (round fresh) in the region totalled approximately 550,000 metric tons in 1965.1/ Of this, 225,000 metric tons was caught by the inshore fleet - 182,000 metric tons in Newfoundland and Labrador, 43,000 in the Maritimes. The remaining 325,000 metric tons of groundfish was captured by the offshore fleet, with 103,000 being caught by Newfoundland trawlers and approximatly 223,000 by Maritime trawlers.

The regional target for 1975 as suggested by the market forecast is a catch of 830,000 metric tons of groundfish (round fresh weight). It is unlikely that by 1975 the inshore fishery will be responsible for more than 200,000 metric tons of the catch,

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1/ To convert from thousand pounds gutted head-on (landed weight) to metric tons (round fresh weight) multiply landed weight by 1.2 (to make conversion from gutted head-on to round fresh), and multiply by 0.454 (to convert to metric tons).

leaving 630,000 metric tons to be caught by the offshore trawler fleet. This represents an increment in the offshore catch in the decade 1965-1975 of 305,000 metric tons.

There is no doubt that, in total, sufficient resources exist to permit expansion to this level for the North Atlantic fisheries as a whole. In 1965, considering only those areas where Canada fishes (Subareas 3, 4 and 5) and excluding species which we do not catch (such as silver hake), Canada caught only about 38 per cent of the 1.5 million metric tons of groundfish caught by all the fishing nations of the North Atlantic. The increment of 305,000 metric tons required by 1975 would bring the Canadian catch up to about 830,000 metric tons, about 55 per cent of the total catch in Subareas 3, 4 and 5 in 1965.

Catch Trends

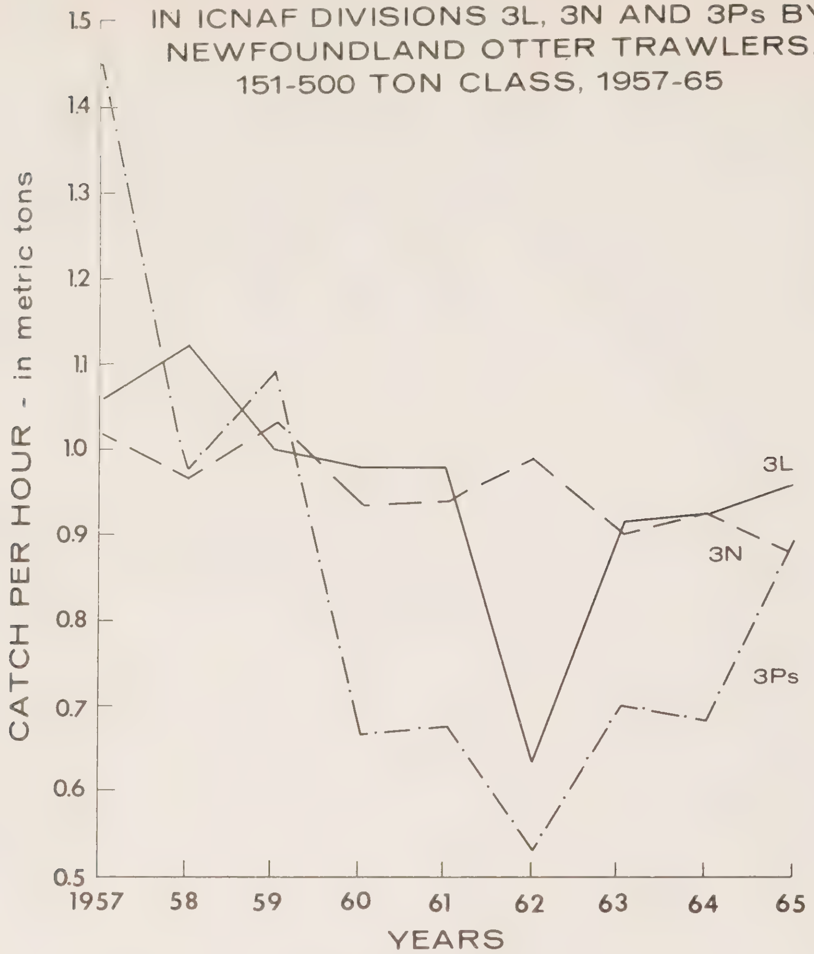
Competition in the North Atlantic fishery is fierce. During the period 1960-65 Canada added 129 trawlers over 50 tons to the fleet, and increased its groundfish trawler catch by 136,000 metric tons. At the same time the other North Atlantic fishery nations increased their catch by 325,000 metric tons. Canada took only 24 per cent of the increment of the catch for the areas and species which we fish, not even sufficient to maintain the Canadian share of the fishery that existed in 1960. It has been suggested that we must "outfish" our competitors if we are to maintain our place in the North Atlantic fishery. On a vessel-to-vessel comparison, we are outfishing our competition now, as we have in the past. Our major competitors nevertheless find it attractive to continue fishing the Northwest Atlantic grounds. This point is illustrated in Table 6-2.

In 1960 the Russian effort was equivalent to that of Newfoundland in this vessel-size class. The catch per hour was, however, only about 60 per cent of the Newfoundland catch and the catch per day only about 42 per cent of the Newfoundland vessels, since the Russians fished only about eight hours per day. In 1965, in spite of this experience, the Russians had increased their effort by 4.5 times, and had a catch per hour which was 30 per cent lower than in 1960. The fact that the Canadian fleet is more than twice as efficient as their own obviously has no bearing on the Russian decision to fish. What is more significant is that the increased effort by other nations has led to a decline in Canadian return per unit of effort.

This is illustrated in Figures 6-1 and 6-2 and in Appendix Tables A-9, A-10 and A-11. Figure 6-1 shows the yield per unit of effort since 1957 in Divisions 3L, 3Ps and 3Pn. There is considerable fluctuation, depending on year-classes and general fishing conditions, but the trend is quite clearly downward. In contrast, Figure 6-2 illustrates the experience of mainland otter trawlers fishing in Divisions 4Vs, 4Vn and 4W. Here catches were lower initially than in the Newfoundland waters

FIGURE 6-1

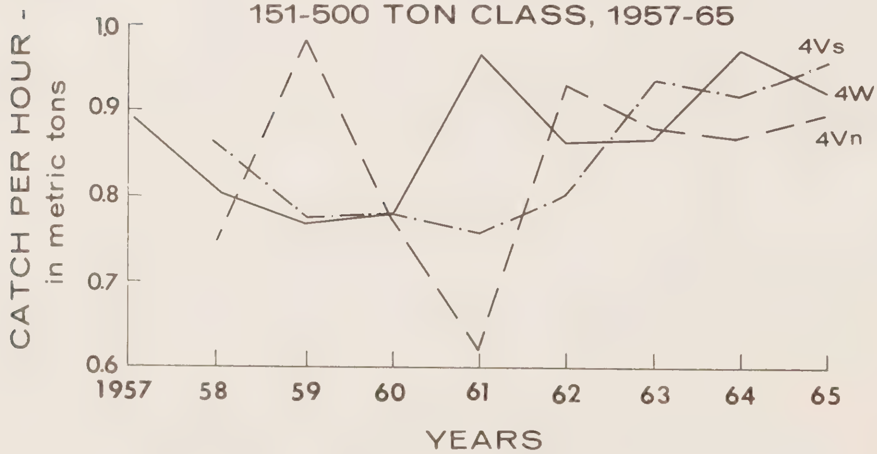
TONS OF FISH CAUGHT PER HOUR FISHING IN ICNAF DIVISIONS 3L, 3N AND 3Ps BY NEWFOUNDLAND OTTER TRAWLERS, 151-500 TON CLASS, 1957-65



Source: ICNAF Statistical Bulletins

FIGURE 6-2

TONS OF FISH CAUGHT PER HOUR FISHING IN ICNAF DIVISIONS 4Vn, 4Vs AND 4W BY MAINLAND OTTER TRAWLERS, 151-500 TON CLASS, 1957-65



Source: ICNAF Statistical Bulletins

shown in Figure 6-1, but they have maintained themselves well and perhaps have even increased slightly. It would be expected that the new equipment added to the fleet during this period should produce higher yields per vessel; that the trend is definitely downward in Newfoundland and stable for the mainland indicates that the effect of fishing pressure is beginning to be felt.

This tendency in more generalized terms can be seen in Table 6-3.1/

TABLE 6-2

Fishing Effort and Catch, ICNAF Subarea 3, Otter Trawlers*

	Days Fished	Hours Fished	Total Catch	Catch Per Day Per Vessel	Catch Per Hour Per Vessel
			------ metric tons -------		
1960					
Canada (Mainland)	1,799	23,496	24,065	13.37	1.02
Canada (Nfld.)	3,621	43,989	43,998	12.15	1.00
U.S.S.R.	5,220	43,705	26,377	5.05	0.60
1965					
Canada (Mainland)	1,172	15,684	14,890	12.70	0.94
Canada (Nfld.)	5,333	68,043	63,316	11.87	0.93
U.S.S.R.	19,179	197,615	82,586	4.30	0.42

* 151-500 ton class.

Source: ICNAF statistical bulletin, vols. 10 and 15. Dartmouth, Nova Scotia. 1962, 1967.

1/ The figures in Table 6-3 are not comparable to Figure 6-1 or 6-2. Table 6-3 indicates the total catch for all vessels over 50 tons, over the whole year and in all fishing areas. In Figure 6-1 and 6-2, the variables of time and area are held constant, and only vessels from 151 to 500 tons are considered.

TABLE 6-3

Catch of Otter Trawlers 50 Tons and Over, Atlantic Coast Fisheries, 1961-1965

Item	1961	1962	1963	1964	1965
Mainland Canada					
No. of trawlers	105	120	167	196	211
Catch (metric tons)	106,214	111,851	120,907	155,806	182,992
Catch per trawler (metric tons)	1,012	932	724	795	867
Newfoundland					
No. of trawlers	30	31	42	43	53
Catch (metric tons)	57,857	61,402	63,453	75,348	101,874
Catch per trawler (metric tons)	1,929	1,981	1,511	1,752	1,922

Source: ICNAF statistical bulletins, vols. 11-15, Dartmouth, Nova Scotia. 1961-1965.

The available statistics provide only a short-term comparison, and because they include all vessels over 50 tons are particularly susceptible to the influence of the increased catching power of recently-added large trawlers. However, the period from 1962 to 1965 was one of steadily increasing over-all catches in the ICNAF area. (See Figure 6-3.) The year 1961 was one in which the total Canadian Atlantic fishery exhibited a downturn, contrary to the experience of other catching nations. With over-all catch prospects relatively poor, the experience of Mainland Canada trawlers in 1961 is therefore particularly outstanding.

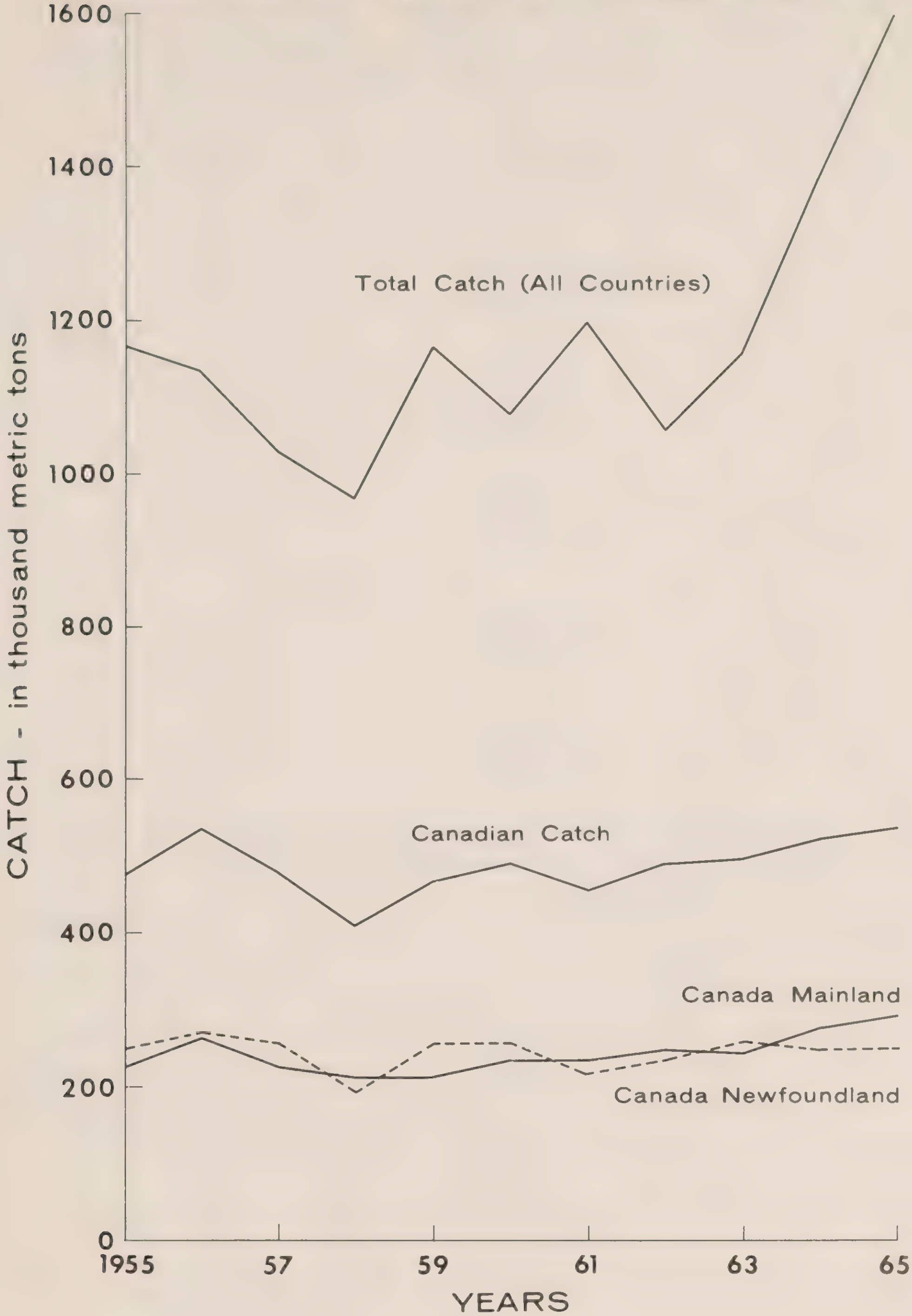
For Mainland Canada and Newfoundland the trend toward decreasing catch per vessel was arrested and reversed after 1963, presumably by the addition of larger and more efficient trawlers.

Fleet Expansion: Estimates of 1975 Performance

Table 6-4 shows the results of a 1966 Atlantic Development Board survey of the intentions of fish-processing plants with regard to expansion of their trawler fleets and the anticipated productivity of their vessels. The areas described are shown in Figure 6-4.

FIGURE 6-3

TOTAL NORTH ATLANTIC GROUNDFISH CATCH AND CANADIAN CATCH IN SUBAREAS 3, 4 AND 5, FOR SPECIES FISHED BY CANADA, 1955-65



Source: ICNAF Statistical Bulletins

TABLE 6-4

Catch Per Offshore Vessel (Trawlers and Draggers) 1965 and 1975

Area	No. of Vessels	Offshore Catch	Catch Per Vessel	Increase
	no.	metric tons (round fresh weight)		%
Fundy				
1965	40	18,600	466	57
1975	53	39,000	733	
Eastern N.S.				
1965	39	74,500	1,900	24
1975	58	136,000	2,350	
Western N.S.				
1965	65	79,200	1,220	12
1975	88	121,000	1,370	
Gulf				
1965	93	41,500	446	18
1975	145	76,500	528	
Southern Nfld.				
1965	25	66,500	2,660	0
1975	63	169,000	2,660	
Eastern Nfld.				
1965	16	20,750	1,300	69
1975	50	110,000	2,200	

NOTE: Fundy - includes plants from Digby, Annapolis, Kings, Hants Counties, Nova Scotia, and Charlotte, St. John and Albert Counties, New Brunswick.
Eastern Nova Scotia - includes plants from Cape Breton, Richmond, Guysboro, Victoria Counties.
Western Nova Scotia - includes plants from Halifax, Lunenburg, Queens, Shelburne, and Yarmouth Counties.
Gulf - includes plants in Prince Edward Island; Westmorland, Kent, Northumberland, Gloucester, Restigouche Counties, New Brunswick, and Cumberland, Colchester, Pictou, Antigonish and Inverness Counties, Nova Scotia. Areas N, M, L, K, in Newfoundland.
Southern Newfoundland - Areas J, I, H.
Eastern Newfoundland - Areas G, F, E, D, C, B, A & O.

Source: Responses to a questionnaire by fish plants, Atlantic Development Board.

FIGURE 6-4


FISH LANDING AREAS
IN THE ATLANTIC PROVINCES
(See Table 6-4)
LABRADOR
QUEBEC
St Anthony
GULF
EASTERN NEWFOUNDLAND
SOUTHERN NEWFOUNDLAND
Harbour Grace
BURIN PEN
Gulf of St. Lawrence
Caraquet
Shippegan
GULF
NEW
BRUNSWICK
P.E.I.
U.S.A.
FUNDY
GULF
GULF
EASTERN N.S.
Strait of Canso
St Andrews
Blacks Harbour
FUNDY
WESTERN N.S.
Halifax
Lunenburg
Yarmouth
Pubnico
Shelburne

Most vessel operators expect their 1975 fleet to have a much higher productivity than their present fleet. To some extent this is justified. All operators expect to retire some of their oldest vessels and add many large trawlers of more efficient design, particularly stern trawlers.

Table 6-5 indicates the age composition of the fleet if the operators' intentions to add new vessels and retire older ones is fulfilled by 1975.

TABLE 6-5

Age Composition of Anticipated 1975 Fleet, Atlantic Provinces

Area	No. of Vessels	Pre-1965		Post-1965	
	no.	no.	%	no.	%
Fundy	53	40	75	13	25
Eastern Nova Scotia	58	26	45	32	55
Western Nova Scotia	88	53	60	35	40
Gulf	145	87	60	58	40
Southern Newfoundland	63	18	29	45	71
Eastern Newfoundland	50	9	18	41	82
Total	457	233	51	224	49

Source: Responses to a questionnaire by fish plants, Atlantic Development Board.

There is some relationship between the age of the fleet and its anticipated performance. The greatest increase in catch per vessel is expected in Eastern Newfoundland, where the bulk of vessels will be new additions to the fleet. It would seem, however, that the expectations of the Fundy operators are very optimistic, considering that 75 per cent of their 1975 fleet would be of pre-1965 vintage.

The operators in Southern Newfoundland, who currently report the highest catch per vessel, do not anticipate any improvement. This reflects the fact that these operators have had access to relatively unexploited fishing grounds which can be expected to decline substantially in their productivity.

The operators in Western Nova Scotia are also cautious. They anticipate only a 12-per-cent increase in catch per vessel despite the fact that 40 per cent of their fleet is expected to consist of post-1965 vessels.

It would seem that the caution of the operators in Western Nova Scotia is warranted. As we have seen, despite the addition of new and larger equipment to the fleet, experience over the last decade has indicated either a decline in catch per vessel or, at best, maintenance of the catch. There is no reason to believe that the pressure on the fishery by foreign vessels will abate during the next decade. The Russians, for example, have increased their fishing pressure tremendously in the recent past, in spite of low and declining levels of productivity.

A close approximation of the expectations of the vessel owners is obtained if existing vessels are assumed to experience a decline in catch of 10 per cent by 1975, while new vessels (added after 1965) are expected to catch 50 per cent more. This is not an unreasonable assumption on the basis of recent experience. New stern trawlers are known to catch up to 50 per cent more under present conditions than the older trawlers. Trawlers in use in 1965 will be 10 years older by 1975 and their performance might naturally be expected to have declined by 10 per cent, owing to the aging of the equipment alone.

In Table 6-6 the result of this method of projection is shown, except for Southern Newfoundland, where no change in catch per vessel was expected.

TABLE 6-6

1975 Catch Assuming a 10-per-cent Decline in Catch of Pre-1965 Vessels and a 50-per-cent Increase in Post-1965 Vessels

Location	Catch (round fresh groundfish)
	metric tons
Fundy	25,900
Eastern Nova Scotia	135,500
Western Nova Scotia	122,000
Gulf	76,000
Southern Newfoundland	169,000*
Eastern Newfoundland	90,700
Total	619,600

* Assumptions not applied to Southern Newfoundland.

It will be noted that this method produces the same estimates as those of vessel owners in Eastern and Western Nova Scotia and the Gulf, and the over-all estimates approach the market estimates for 1975 of 630,000 metric tons of offshore fish. The major changes are in the Fundy and the Eastern Newfoundland estimates. However, all the estimates are probably optimistic since they assume basically the same abundance of fish in 1975 as exists at present. A British study (Great Britain, 1965) noted:

> The conclusion must be that a large increase in factory-ship or mother-ship operations will lead to a general decline in stocks. Because the fleets are highly mobile, particularly the Russians, this is likely to result in a very equal distribution of catch per hour on all grounds. Thus, at the present catch rates, Newfoundland is attractive to factory-ships, and Labrador and West Greenland slightly less so, so that future fishing at Newfoundland by factory trawlers is likely to increase. . . .

The British study's estimates indicated a decline in catch per unit of effort from 1963 to 1973 of 28 per cent in Newfoundland and Labrador waters. The estimates of Canadian owners are probably based on current experience. Large stern trawlers may be able to catch 50 per cent more at present; it is unlikely that they will be able to do so in 1975 when fishing effort, both from Canadian expansion and foreign competition, is likely to be greater.

For 1975 a more realistic assumption would be that the catch from pre-1965 vessels will have declined by 20 per cent, while new vessels will have catch increases of 30 per cent, rather than the 50 per cent that they now seem capable of producing. The calculation of the catch on this more conservative, but probably more realistic, basis is shown in Table 6-7.

TABLE 6-7

1975 Catch Assuming a 20-per-cent Decline in Catch of Pre-1965 Vessels and a 30-per-cent Increase in Post-1965 Vessels

Location	Catch (round fresh groundfish)
	metric tons
Fundy	22,900
Eastern Nova Scotia	118,500
Western Nova Scotia	108,000
Gulf	65,000
Southern Newfoundland	134,000
Eastern Newfoundland	78,400
Total	526,800

Implications of Meeting 1975 Production Targets

What are the implications in terms of the resource and fishing pressure for Canada to attempt to capture 830,000 metric tons of groundfish by 1975? If the distribution of effort were to remain the same as in 1965, landings would be distributed approximately as shown in Table 6-8.

TABLE 6-8

Projected Groundfish Landings by Area in 1975*

Area	1965 Share	1975 Landings
	%	000 metric tons
Fundy	5.0	41
Eastern Nova Scotia	14.4	120
Western Nova Scotia	18.8	157
Gulf	11.0	92
Southern Newfoundland	24.1	199
Eastern Newfoundland	26.7	221
Total	100.0	830

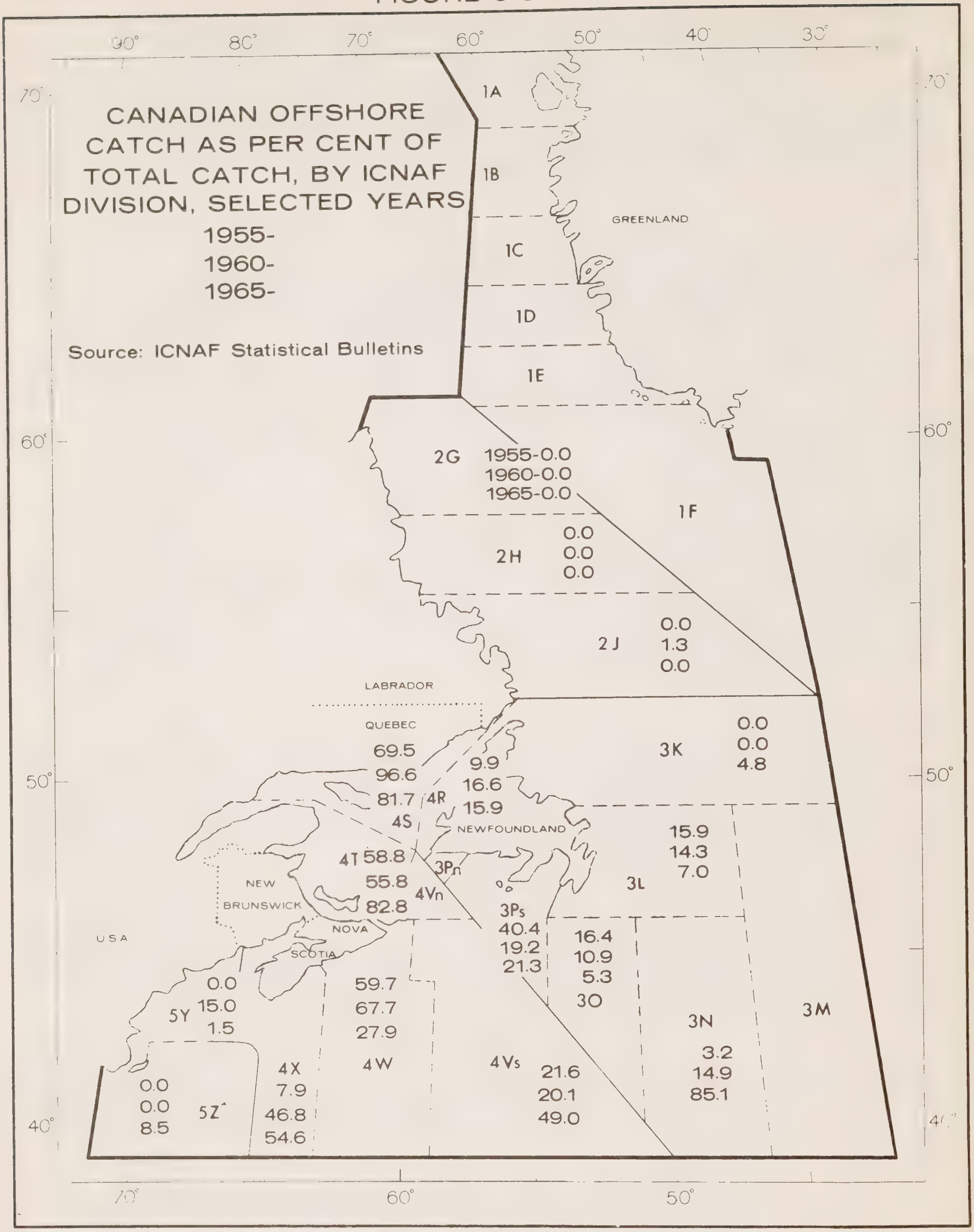
* Assuming distribution of 830,000 metric tons according to 1965 proportions of catch.

This projection in turn can be compared with the catches produced by the ICNAF Subareas in which the landing areas have some locational advantage. The Canadian offshore fleet is characterized by the relatively small radius within which it fishes. Only 5.9 per cent of the Maritime catch in 1965 came from Subarea 3. Similarly only 3.9 per cent of the Newfoundland catch came from Division 4V, 2.6 per cent from 4Vn, which lies closest to Newfoundland, with no catches from Divisions 4W or 4X or Subarea 5. In addition, only very modest competition for the offshore catch was exerted in Divisions 3L and 3K by the Newfoundland offshore fleet. (<u>See</u> Figure 6-5.)

The radius of catch seems to be contracting rather than expanding with the addition of new vessels. (<u>See</u> Appendix Tables A-12, A-13, A-14.) In 1955 13.1 per cent of the Maritime catch came from Subarea 3, in 1960 12.7 per cent, and in 1965 only 5.9 per cent.

The bulk of the fish seems to be captured within 300 miles of the home port, approximately one day's steaming time from port. Since the fleet is not equipped for freezing on board, the general length of voyage is no more than about 10 days, the

FIGURE 6-5


CANADIAN OFFSHORE CATCH AS PER CENT OF TOTAL CATCH, BY ICNAF DIVISION, SELECTED YEARS
1955-
1960-
1965-
Source: ICNAF Statistical Bulletins
90°
80°
70°
60°
50°
40°
30°
70°
60°
50°
40°
1A
1B
1C
1D
1E
1F
GREENLAND
2G
1955-0.0
1960-0.0
1965-0.0
2H
0.0
0.0
0.0
2J
0.0
1.3
0.0
LABRADOR
QUEBEC
3K
0.0
0.0
4.8
69.5
96.6
81.7
4R
4S
9.9
16.6
15.9
NEWFOUNDLAND
3L
15.9
14.3
7.0
4T
58.8
55.8
82.8
3Pn
4Vn
NEW BRUNSWICK
NOVA SCOTIA
USA
3Ps
40.4
19.2
21.3
16.4
10.9
5.3
3O
3N
3.2
14.9
85.1
3M
5Y
0.0
15.0
1.5
59.7
67.7
27.9
4W
4Vs
21.6
20.1
49.0
4X
7.9
46.8
54.6
5Z
0.0
0.0
8.5

limit for effective preservation of the catch by icing.[1/]

The relatively short steaming time to the grounds, the avoidance of the expense of elaborate freezing equipment, and preparation of fish for the freezer aboard vessels, constitute a major advantage to the Canadian fishery over its foreign competitors.

This restriction on radius of operations makes it possible to consider the type of competitive pressure each major area will face in reaching the catch objectives suggested in Table 6-8.

The Fundy and Nova Scotia areas have the greatest locational advantage in ICNAF Divisions 4V, 4W and 4X, which in 1965 produced a total of 311,000 metric tons of groundfish to the ships of all nations, Canadian vessels landing 51.6 per cent of this total. In 1965, 5Y and 5Z produced 361,000 metric tons of groundfish, of which Canada accounted for only 8.0 per cent, since Canadian ports are not well located to prosecute the fishery in this area. However, if the market forecast volume of landings for 1975 were to be achieved and landings were to be distributed in a pattern similar to that of 1965, a total of 318,000 metric tons would be landed in the Fundy and Nova Scotia areas. To achieve this would require the capture of 100 per cent of the 1965 landings from Divisions 4V, 4W and 4X.

In the Gulf the distribution of landings on the 1965 basis would give the Gulf ports 92,000 metric tons in 1975 (excluding Québec). This represents 53 per cent of the 175,000 metric tons caught from ICNAF Divisions 4R, 4S and 4T by all countries in 1965.

For Southern Newfoundland, the 1975 distribution of landings gives a total of 199,000 metric tons of groundfish. The 1965 catch from 3M, 3N and 3P, where Southern Newfoundland has the greatest locational advantage, was 253,000 metric tons by all nations, of which Canada accounted for 51.2 per cent. For Southern Newfoundland to meet the 1975 objective it would have to capture the equivalent of about 80 per cent of the landings of all nations in these divisions in 1965. For Eastern Newfoundland, the 1975 forecast indicates landings of 221,000 metric tons. This area has the greatest locational advantage in ICNAF Divisions 3K, 3L and 3M, where 1965 landings by all nations were 420,000 metric tons, of which Canadian landings accounted for 28.5 per cent. The forecast 1975 landings would require the capture of 53 per cent of the 1965 volume of fish from these divisions. In addition, Eastern Newfoundland is better located than any other Canadian area to prosecute the fisheries off Labrador (ICNAF Subarea 2) where 331,000 metric tons of groundfish were caught by all nations in 1965, of which Canada accounted for 8.1 per cent, entirely by inshore vessels.

1/ Some markets accept catches held on ice as long as 21 days, but the 10-day limit is generally applicable in the Atlantic fisheries.

Trends in the Location of Catch

The implication of the preceding discussion is that substantial increases in landings are not likely to take place by simple accretions of capacity and vessels in existing locations. There has been some change in landing patterns in the last five years; no doubt even more significant shifts will occur in the future. (See Table 6-9.)

TABLE 6-9

Per Cent of Total Canadian Groundfish Landings by Area, 1960 and 1965

Area	1960	1965
	%	%
Fundy	3.99	4.97
Eastern Nova Scotia	13.27	14.44
Western Nova Scotia	19.21	18.75
Gulf	11.99	11.05
Southern Newfoundland	20.22	24.09
Eastern Newfoundland	31.31	26.68
Total	100.00	100.00
Total Groundfish Landings (lbs.)	812,540,000	1,018,013,000

Fundy and Western Nova Scotia together retained approximately the same share of the catch, 23.2 per cent in 1960, 23.7 per cent in 1965. Eastern Nova Scotia ports increased their share by 1.2 percentage points while Gulf ports declined by 0.9. Newfoundland's total share of the catch remained fairly stable, 51.5 per cent in 1960 and 50.8 per cent in 1965, but substantial internal shifts took place, with an increase of 3.8 percentage points in Southern Newfoundland's share, and a decrease of 4.6 percentage points in Eastern Newfoundland's. This shift mirrors the decline of the inshore fishery and the growth of the offshore trawler fishery in Southern Newfoundland.

Table 6-10 illustrates the relationship that existed in 1965 between the catching areas and the landing areas we have been considering.

TABLE 6-10

Canadian Groundfish Catch and Landings, by Areas, 1965

Landing Area	Landings	Catching Area	Canadian Catch
	metric tons	ICNAF Division	metric tons
Fundy, Eastern Nova Scotia, Western Nova Scotia	211,700	4V,4W,4X 5Y,5Z	189,382
Gulf (including Québec)	109,300	4R,4S,4T	133,547
Southern Newfoundland	134,000	3M,3N,3P	129,453
Eastern Newfoundland	147,500	3K,3L,3M 2V,2H,2G	146,536

Though it is true that many vessels from Southern Newfoundland fish in Divisions 4V, 4W and 4X, and Nova Scotia vessels fish in Subarea 3, and so forth, it is clear that on balance vessels from Southern Newfoundland, and probably most significantly from Eastern Nova Scotia, outfish the Gulf vessels in the Gulf fishery. Canadian vessels based on the open Atlantic can fish into the Gulf later in the fall and earlier in the spring than can Gulf-based vessels.

In 1965 only about 82 per cent of the Canadian Gulf catch was actually landed at Gulf ports. Some 24,000 metric tons of groundfish were caught in the Gulf by Canadian vessels but landed outside the Gulf, either in Eastern Nova Scotia or Southern Newfoundland. If the regional Gulf landings of 92,000 metric tons and the anticipated Québec 1975 landings of 90,000 metric tons were to constitute a similar percentage (i.e., 82 per cent) of the 1975 catch, the total Canadian Gulf catch would have to be of the order of 182,000 metric tons. This can be compared with 175,000 metric tons caught by all nations in these waters in 1965.

The changing catch pattern when Canada is considered in the context of the total Northwest Atlantic fishery is also of interest. Table 6-11 indicates that Canada is everywhere competitive, and is increasing its share of the catch (though from very low shares in Subareas 2 and 5), except in Divisions 3K, 3L and 3M. The declining Canadian share of the total catch is entirely due to declining shares in these areas to the north and east of Newfoundland. They are also the only areas where the absolute volume of the Canadian catch has decreased. In these areas, the relative decrease in the efficiency of the

TABLE 6-11

Distribution of Catch, All Countries and Canada, 1960 and 1965

ICNAF Division	(1) Total Catch All Countries	(2) % of Total Catch by Subareas	(3) Total Catch - Canada	(4) % of Canada Catch by Subareas	(5) % Canada of Total Catch by All Countries	(6) Increase or Decrease (-) in % Share of Total Catch
1960						
	metric tons	%	metric tons	%	%	%
2G,2H,2J	234,502	18.19	16,692	3.42	7.12	
3K,3L,3M	343,499	26.65	167,933	34.85	48.88	
3N,3O,3P	219,582	17.04	78,720	16.15	35.84	
4R,4S,4T	159,519	12.38	109,062	22.37	68.37	
4V,4W,4X	216,834	16.83	110,459	22.65	50.94	
5Y,5Z	114,746	8.90	4,635	0.95	4.04	
Total	1,288,682	100.00 %	487,501	100.00 %		
1965	(1)	(2)	(3)	(4)	(5)	
2G,2H,2J	330,615	17.87	26,746	4.47	8.10	0.98
3K,3L,3M	419,872	22.69	119,740	19.19	28.52	-20.36
3N,3O,3P	252,795	13.66	129,453	21.61	51.21	15.37
4R,4S,4T	175,049	9.47	133,547	22.28	76.29	7.92
4V,4W,4X	310,574	16.74	160,281	26.76	51.61	0.67
5Y,5Z	361,170	19.52	29,101	4.86	8.05	4.01
Total	1,850,075	100.00 %	598,868	100.00 %		

Source: ICNAF statistical bulletins.

inshore fishery, in spite of substantial additions of men and gear, has not been compensated for by the growth of an offshore fishery.

The other feature that the trend in the location of catch indicates is the increasing dependence on what might be termed the "Laurentian Bight" (shaded area, Figure 6-6). The area from Cape Sable, Nova Scotia to Cape Race, Newfoundland, including the Gulf of St. Lawrence and comprising all of Subarea 4 and Divisions 3N, 3O and 3P, accounted for 61.2 per cent of the Canadian catch in 1960 and 70.6 per cent in 1965. Subareas 2 and 5 are virtually unutilized by Canadian fishermen, and although our share of the catch in these areas increased between 1960 and 1965 it was still less than 10 per cent of the total catch by all nations. Canadian vessels caught 50.0 per cent of the groundfish in the Laurentian Bight in 1960 (298,000 of 596,000 metric tons caught by all nations). By 1965 the Canadian share had increased to 57.5 per cent (423,000 of 738,000 metric tons).

As the Canadian fisheries' dependence on the resource of the Laurentian Bight has increased, the area's contribution to the total North Atlantic fishery has declined. The Laurentian Bight's share of the total Northwest Atlantic catch declined from 46.2 per cent in 1960 to 39.9 per cent in 1965. The conclusion is that in the areas where we do fish heavily we have been able to increase our share of the catch. It is probable that other nations have concentrated more on fishing in other areas because they find catches better in areas where our catch is declining, or where we do not prosecute the fisheries vigorously.

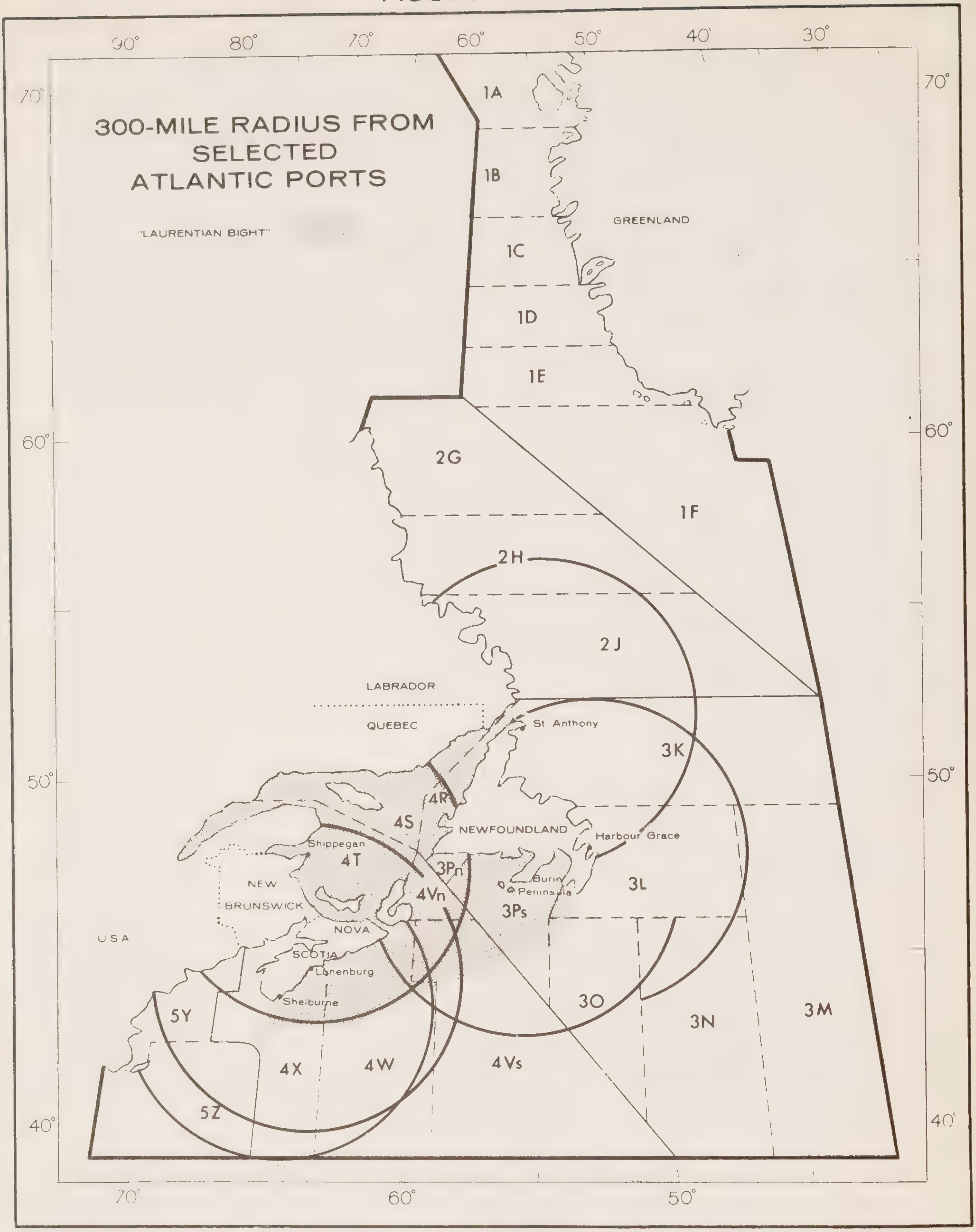
Trends in the Location of Landings

Table 6-12 indicates the relationship between volume of catch and value of catch for the various fish-landing areas in the region.

The highest value per pound of groundfish landed is obtained in Western Nova Scotia, 75 per cent higher than in the area of lowest value per pound of landing, Southern Newfoundland. In part this can be explained by the landing of a greater proportion of higher-valued species in Western Nova Scotia. However, when considering only a single species, cod, Western Nova Scotia and Fundy still retain the highest landed values per pound.

This is probably explained by the ability of these areas to market a substantial share of their landings on the high-value fresh-fish market, a market that they dominate by virtue of a combination of good transportation connections and ability to land fish year-round. In this connection the poor showing of Eastern Nova Scotia is somewhat surprising. This area enjoys a 12-month landing season, but the poor road connec-

FIGURE 6-6



300-MILE RADIUS FROM
SELECTED
ATLANTIC PORTS
"LAURENTIAN BIGHT"
90°
80°
70°
60°
50°
40°
30°
1A
1B
1C
1D
1E
1F
GREENLAND
2G
2H
2J
LABRADOR
QUEBEC
St. Anthony
3K
4R
4S
NEWFOUNDLAND
Harbour Grace
Shippegan
4T
3Pn
NEW
BRUNSWICK
4Vn
Burin
Peninsula
3L
3Ps
USA
NOVA
SCOTIA
Lunenburg
Shelburne
5Y
3O
3N
3M
4X
4W
4Vs
5Z

tions to ports such as Canso, Petit-de-Grat, and Louisbourg and the distances to major American markets presumably explain why their landed values are about 30-per-cent lower, in the case of cod, than ports in Western Nova Scotia and Fundy.

TABLE 6-12

Volume and Value of Groundfish Landings by Fishing Areas, 1965

Area	All Groundfish						Cod	
	Quantity		Value		Value Per lb.	Index* of Value Per lb.	Value Per lb.	Index* of Value Per lb.
	000 lb.	%	$ 000	%	¢		¢	
Fundy	50,664	4.58	2,771	6.24	5.47	172.50	4.90	133.10
Eastern Nova Scotia	147,044	13.28	5,766	12.98	3.92	123.64	4.27	116.03
Western Nova Scotia	190,840	17.24	10,592	23.85	5.55	175.08	5.02	136.41
Gulf	112,538	10.17	3,999	9.00	3.55	111.99	4.03	109.51
Southern Nfld.	245,322	22.17	7,794	17.55	3.17	100.00	3.68	100.00
Eastern Nfld.	271,590	24.54	10,313	23.22	3.79	119.56	3.99	108.42
Québec	88,480	7.99	3,164	7.12	3.57	112.62	3.93	106.79

* Southern Newfoundland = 100.

Source: Fisheries statistics of Canada, 1965. D.B.S.

Primary fishermen then can be seen to create value in their product by the direction in which they move it after capture. However, since offshore vessels are predominantly owned by the fish-processing companies, the individual captain and crew have no opportunity to discriminate between points of landing. A major price differential can therefore remain as a relatively permanent feature of the Atlantic coast fishery.

There are inherent inefficiencies in this distortion of the marketing structure. If individual captains were free to choose the port at which to land, more would presumably elect to land their catches at ports and plants where the highest values could be obtained, until the increased supply offered brought about a new price equilibrium. Under free-market condi-

tions, therefore, the Fundy and Western Nova Scotia ports would probably obtain a greater percentage of the Atlantic coast catch. It is likely that fewer ports would result as well, since there would be a tendency for fish to move toward ports that generate the highest demand bids, which would be those that require the greatest volume of fish and have a number of plants to bid for the product.

Vertical integration of catching and processing fish, including ownership of fishing vessels, can therefore be considered as instrumental in preserving the superfluity of fish-processing plants on the Atlantic coast. Certainly this practice has prevented rationalization of fishing harbours through the market mechanism.

The foregoing discussion should not be construed to suggest that vertical integration has not conferred real benefits on the firm and industry. The firm has benefited by obtaining control over its supplies and the price it pays for raw material, the industry as a whole has benefited by the injection of capital provided by the processing companies, which has enabled the rapid adoption of modern capital-intensive fishery equipment in the form of large steel trawlers. However, to the extent that vertical integration has inhibited concentration of landings in single ports and encouraged the preservation of small firms, the effect has been counter-productive. In terms of raising incomes, improving productivity and increasing efficiency, the advantage clearly lies with larger firms. This advantage will be examined in the section on Processing Plants.

To sum up, the following major trends can be observed in the fishery:

1) A declining catch per unit of effort.

2) A contracting area of catch. More Canadian effort is being concentrated in the Laurentian Bight, little new effort is being applied to the grounds to the north or south, in Subarea 2 off Labrador, in Subarea 3 to the north and east of Newfoundland or in Subarea 5 to the south of Nova Scotia.

3) The contraction in area of catch has been paralleled by some concentration of landing and processing in certain areas. Shares of groundfish landings have declined in the Gulf, Western Nova Scotia and Eastern Newfoundland.

Greater concentrations of landing and processing facilities would be desirable to increase the values created by the industry, but not necessarily in the areas where growth has been occurring in the past.

7. PROCESSING PLANTS

Fish-processing establishments are located in approximately 300 communities in the Atlantic Provinces (see Appendix Table A-19). In total these plants provide employment for approximately 11,000 people, 90 per cent employed in production functions and 10 per cent in service and management. During 1965, the average income per employee in fish-processing plants (from fish processing) was almost $2,300, and ranged from a low of $1,870 per employee in Prince Edward Island to $2,650 in Nova Scotia (D.B.S., 1965). In New Brunswick and Newfoundland average fish-processing income was $2,150 per employee.

At present there are approximately 520 fish-processing plants in the Atlantic Provinces. However, any observer examining these plants would probably classify at least half of them as improved fish houses or stores. According to information published by the Dominion Bureau of Statistics for 1965 there are 256 "establishments" in the Atlantic area. The principal statistics available for these establishments on a provincial basis are as follows.

TABLE 7-1

Fish-Processing Establishments, Atlantic Provinces, 1965

Item	Unit	Nfld.	P.E.I.	N.S.	N.B.
Establishments	no.	51	17	116	72
Production Workers	no.	3,635	460	4,192	2,399
Man Hours Paid	000	7,540	900	8,962	5,104
Wages	$ 000	7,818	861	11,033	5,162
Cost of Fuel and Electricity	$ 000	974	109	1,185	531
Cost of Material and Supplies	$ 000	23,156	4,270	51,396	20,906
Value of Shipments	$ 000	40,813	5,737	76,997	31,021
Value Added	$ 000	17,139	1,469	24,572	9,721

Source: Fish Products Industry, 1965. D.B.S.

During 1966, the latest year for which complete product statistics are available, Atlantic Provinces fish processors produced products valued at $212.3 million, f.o.b. plant. Included in the 1966 production were 253 million pounds of frozen fish, 209 million pounds of fresh fish, 11 million pounds of smoked fillets, 11 million pounds of boneless salted fish, 40 million pounds of dried salted, 44 million pounds of green salted, as well as 114,319 barrels of pickled fish.

The newest and most rapidly developing segment of the fish-processing industry is herring reduction. Prior to 1965, most fish-reduction plants (usually integrated with a filleting operation) were dependent upon waste material from the groundfish operations. However, during 1965-66 new herring-reduction facilities were constructed at Pubnico, Caraquet, Saulnierville, and Harbour Breton. At the present time plants are being built at Lower East Pubnico and Yarmouth and are planned for at least three additional locations. The success of these ventures depends to a large extent upon the world fishmeal market (which has in recent years depended upon Peruvian production), and on the utilization of the herring resource.

The range, quality and type of products produced in the fish plants of the Atlantic Region have improved steadily. However, additional changes and improvements may be required in some products. The preparation of precooked fishery products along with other food products in the same package has helped maintain fish consumption. Many fish species, however, are processed in basically the same way today as in past centuries. Bloaters and pickled fishes could certainly be packaged and prepared using more modern methods. By improving processing, packaging, shipping and holding methods, new markets might be developed, and in a few instances traditional markets might be willing to pay more for an improved traditional product.

Interprovincial Comparisons of Fish-Processing Plants

Table 7-2 gives some insight into the character of fish-processing establishments. As might be expected, the cost of materials and supplies - principally raw fish - constitutes the most important component of the value of goods shipped. The variations between the provinces of this cost component reflect the dockside values for landed fish and the species mix. Fish prices are lowest in Newfoundland where raw materials constitute 56.7 per cent of the value of shipments, the lowest for any province.

In Newfoundland, wages represent a higher percentage of the value of shipments, 18.5 per cent as compared with 11.6 per cent in Nova Scotia. Labour in Nova Scotia plants seems to be employed much more efficiently, value added per man-hour amounting to $2.74 compared to $2.27 in Newfoundland. Plant labour in Nova Scotia is paid more than in Newfoundland with an average hourly earning of $1.23 compared with $1.04 in the Newfoundland plants.

TABLE 7-2

Plant Efficiencies and Costs in Fish-Processing Plants by Provinces, 1965

Item	Unit	Nfld.	P.E.I.	N.S.	N.B.
Value Added Per Man-Hour	$	2.27	1.63	2.74	1.90
Value Added Per $ of Wages	$	2.19	1.71	2.23	1.88
Average Hourly Earnings	$	1.036	0.957	1.231	1.011
Materials & Supplies as % of Value of Shipments	%	56.7	74.4	66.8	67.4
Wages as % of Value of Shipments	%	18.5	15.7	11.6	16.5
Fuel & Electricity as % of Value of Shipments	%	2.39	1.90	1.53	1.71
Total Materials & Supplies, Wages & Fuel & Electricity as % of Value of Shipments	%	78.9	91.3	82.6	85.7

Source: Fish Products Industry, 1965. D.B.S.

In New Brunswick, cost of materials and supplies runs at about the same level as in Nova Scotia (67.4 per cent of the value of shipments). However, plant efficiencies seem to be substantially lower: $1.90 value added per man-hour compared with $2.74 in Nova Scotia. Average hourly earnings in New Brunswick are substantially lower than in Nova Scotia, slightly lower than in Newfoundland. With slightly lower wage rates than Newfoundland, New Brunswick ends up with 16.5 per cent of the value of shipments represented by wages, about midway between Nova Scotia and Newfoundland. Prince Edward Island plants are notable for their low average hourly earnings, $0.96 per hour. Plant efficiencies, as measured by a $1.63 value added per man-hour, are below those of the other Atlantic Provinces. The low output per man-hour is sufficient, even with low wage rates, to put the value added per dollar of wages at the lowest level in the region.

The cost of materials and supplies as a percentage of the value of shipments is 74.4 per cent in Prince Edward Island, the highest in the region. This reflects the dominance of a single high-value species (lobster) in the Prince Edward Island catch.

The cost of fuel and electricity, wages and raw material together constitute 78.9 per cent of the value of shipments in Newfoundland, 82.6 per cent in Nova Scotia, 85.7 per cent in New Brunswick, and 91.3 per cent in Prince Edward Island.

Trends in Plant Efficiencies

The trends in provincial plant efficiencies from 1961 to 1965 in Table 7-3 illustrate the stability or fluctuation of the characteristics considered for 1965. Throughout this period Nova Scotia had the highest plant efficiencies as measured by value added per man-hour. It also provided the highest average hourly earnings of any of the provinces throughout the period. Hourly earnings in Nova Scotia increased by 14 per cent from 1961 to 1965, but productivity as measured by value added per man-hour increased by 24.5 per cent. The result is that Nova Scotia plants began and ended the period with the highest value added per dollar of wages of any of the provinces, though in interim years both Newfoundland and Prince Edward Island twice placed ahead of Nova Scotia by this measure.

Prince Edward Island consistently showed the lowest average hourly earnings throughout the period covered: 61 per cent of the Nova Scotia average in 1961; 77 per cent in 1965. However, hourly earnings in Prince Edward Island increased very rapidly during the period (47 per cent) compared to a much more modest increase in Nova Scotia (14 per cent). Unfortunately, productivity - as measured by value added per man-hour - did not increase as rapidly as did hourly earnings, with the result that the value added per dollar of wages in 1965 in Prince Edward Island was the lowest in the Atlantic Provinces. Prince Edward Island made its best showing in 1963 when hourly earnings had increased by 17.2 per cent over 1961 and productivity per man-hour by 72 per cent. From 1963 to 1965, hourly earnings advanced by 25.6 per cent while value added per man-hour fell by 18.5 per cent.

New Brunswick occupies an intermediate position, which reflects the nature of its fishery on the Fundy and Gulf shores. The Fundy fishery includes the important sardine canneries, while the Gulf fisheries are dominated (during the period considered) by lobster processing and the groundfishery.

Average hourly earnings were below Nova Scotia levels both at the beginning and end of the period. However, earnings increased at a faster rate than in Nova Scotia from 1961 to 1965,22 per cent, compared with 14 per cent; value added per man-hour increased at a somewhat faster pace, 27.5 per cent over the same period.

In Newfoundland from 1961 to 1965 average hourly earnings increased by 17 per cent while productivity, as measured by value added per man-hour, increased by 31.2 per cent. For 1965 this raised Newfoundland's value added per dollar of wages almost to the level of Nova Scotia's. However, Newfoundland's major advantage has consistently been the low cost of materials and supplies as compared with the other provinces. Materials

TABLE 7-3

Trends in Provincial Plant Efficiencies and Costs, 1961 to 1965

	Value Added Per Man-Hour	Value Added Per $ of Wages	Average Hourly Earnings	Materials & Supplies as % of Value of Shipments	Wages as % of Value of Shipments	Fuel & Electricity as % of Value of Shipments	Total Materials & Supplies, Wages, Fuel & Electr. as % of Value of Shipments
	$	$	$	%	%	%	%
Nfld.							
1965	2.27	2.19	1.036	56.7	18.5	2.39	78.9
1964	2.09	2.11	0.992	59.3	17.8	2.51	79.6
1963	1.63	1.77	0.917	60.4	20.1	3.40	83.4
1962	1.83	2.12	0.863	60.2	18.8	2.64	81.6
1961	1.73	1.96	0.885	56.4	20.4	2.91	79.7
P.E.I.							
1965	1.63	1.71	0.957	74.4	15.7	1.90	91.3
1964	1.60	1.87	0.856	73.4	14.7	1.56	89.7
1963	2.00	2.63	0.762	65.1	13.7	0.90	79.8
1962	1.63	2.40	0.679	66.4	12.9	1.37	80.7
1961	1.16	1.78	0.650	74.6	13.4	1.60	89.6
N.S.							
1965	2.74	2.23	1.231	66.8	11.6	1.53	82.6
1964	2.43	2.08	1.171	68.4	14.6	1.59	84.6
1963	2.19	1.93	1.130	69.5	15.6	1.62	87.1
1962	2.21	2.01	1.094	68.3	15.2	1.65	85.1
1961	2.20	2.06	1.072	63.5	15.7	1.80	81.0
N.B.							
1965	1.90	1.88	1.011	67.4	16.5	1.71	85.7
1964	1.93	2.05	0.941	64.5	15.7	1.61	81.8
1963	1.66	1.84	0.903	69.2	17.1	1.75	88.0
1962	1.35	1.54	0.879	74.7	19.4	2.08	96.1
1961	1.49	1.79	0.829	63.6	16.4	1.84	81.9

Source: Fish Products Industry. D.B.S.

and supplies consist principally of raw fish, where Newfoundland's landed value per pound is the lowest in the region (see Table 6-12). In spite of a productivity level per dollar of wages that is comparable to Nova Scotia's, Newfoundland's wages as a per cent of the value of shipments are the highest in the region. The same is true of fuel and electricity costs as a percentage of value of shipments. It is low raw-material costs that have kept Newfoundland competitive.

Although Table 7-4 relates only to the groundfish part of the fish-processing industry, it illustrates some of the problems that Newfoundland faces.

In Nova Scotia both the product value per pound and landed value per pound are high. But, in spite of the high prices paid for fish in Nova Scotia, the high value of product means that landed value per pound, as a per cent of product value per pound, is among the lowest of the provinces. In Newfoundland the low value per pound of product means that the landed value is also low, but, in spite of the low landed values, the percentage of landed value to product value is higher than in any province except Prince Edward Island.

In Prince Edward Island the groundfish industry is but a small segment of the total fish-processing industry, but it again illustrates the all-important relationship between landed values and product values. In both Newfoundland and Prince Edward Island, from the viewpoint of the processing industry, groundfish prices are too high rather than too low. Landed prices in Newfoundland are 27.6 per cent below those in Nova Scotia, but product prices are 32.6 per cent below. Because it supplies the high-value fresh-fish market, and because it produces more highly finished consumer items, the Nova Scotia industry can pay more for raw material and at the same time maintain a favourable proportionate distribution, in comparison with the other provinces, in the relationship between raw material and product costs. In 1965, for example, Nova Scotia's landed values were 37 per cent of product values. Newfoundland, though its raw material costs are lower than Nova Scotia's and New Brunswick's, nevertheless remains more sensitive to any rise in raw material costs, since they represent a greater proportion of product price than in the other two provinces. In 1965 Newfoundland's landed values were 42.5 per cent of product value.

Size of Firm in Fish Processing

Rising incomes, increased productivity and efficiency of production in the fish-processing industry are accepted economic goals for the region. All are positively correlated to the size of fish-processing firms (Table 7-5). Average hourly wages, the value added per man-hour and the value of shipments per dollar of wages, all tend to increase quite steadily as the size of firm (measured by value of annual shipments) increases, as Table 7-5 illustrates.

TABLE 7-4

Relationship Between Landed Value and Product Value, Groundfish, Atlantic Provinces, 1961-1965

Year	New Brunswick			Prince Edward Island		
	(1) Landed Value Per lb.	(2) Product Value Per lb. of Landings	(3) (1) as % of (2)	(1) Landed Value Per lb.	(2) Product Value Per lb. of Landings	(3) (1) as % of (2)
	$	$	%	$	$	%
1961	.0313	.0699	44.77	.0275	.0616	44.64
1962	.0344	.0889	38.69	.0311	.0640	48.59
1963	.0354	.0866	40.88	.0320	.0683	46.85
1964	.0368	.0968	38.01	.0328	.0732	44.81
1965	.0384	.1099	34.94	.0343	.0784	43.75
	Nova Scotia			Newfoundland		
1961	.0401	.1112	36.06	.0273	.0629	43.40
1962	.0434	.1277	33.98	.0288	.0686	41.98
1963	.0463	.1455	31.82	.0312	.0713	43.75
1964	.0474	.1379	34.37	.0353	.0739	47.76
1965	.0487	.1315	37.03	.0352	.0827	42.56

Source: Fish Products Industry. D.B.S.

Unfortunately, this table includes all fish-processing establishments in Canada, and there is some tendency for firms on the West Coast to be concentrated in the larger size range. However, if one excludes the firms with shipments over $5 million (where most British Columbia firms are likely to be found) the tendency for wages and productivity to increase with increasing scale is still clear.

Because it is the larger firms that are able to create the greater value added, presumably by their ability to prepare products of higher value and by greater efficiency of production, they are also the firms best able to pay higher wages to their workers. This is borne out by the fact that, in 1965, the wage bill for the smallest firms comprised 19.7 per cent of the value of factory shipments, and that this percentage declined steadily with increasing size, to 12.1 per cent for the largest firms.

It can only be concluded that there would be a clear economic benefit to the region if future increases in production were to take place in a relatively small number of large fish-processing plants, rather than in a large number of small plants.

TABLE 7-5

Size of Firm in Relation to Selected Economic Measurements, All Canadian Fish-Processing Firms, 1965

Value of Shipments of Goods of Own Manufacture	Average Hourly Wage of Production Workers	Value Added Per Man-Hour	Output (Value of Shipments) Per $ Wages
	$	$	$
Under $10,000	0.97	2.44	5.06
$10,000 to 24,999	1.03	2.38	4.67
$25,000 to 49,999	1.09	2.12	4.69
$50,000 to 99,999	0.99	2.27	6.92
$100,000 to 199,999	1.05	2.00	5.84
$200,000 to 499,999	1.08	2.27	6.99
$500,000 to 999,999	1.14	2.31	6.73
$1,000,000 to 4,999,999	1.28	3.01	6.90
$5,000,000 and over	1.69	4.91	8.24

Source: Fish Products Industry, 1965. D.B.S.

8. CONCLUSIONS

Exports of Canadian groundfish to the United States suffered a setback in 1967, largely as a result of the American Bishops' Decree on Friday fasting. Although this event has had a disruptive effect on the Canadian fishery, there is evidence that it is an isolated event and that the United States market will resume its recent average growth rate of 5 per cent a year. On the basis of preliminary analysis it is projected, then, that by 1975 the total market for groundfish landed in the Atlantic Region will increase by 50 per cent over the 1967 level, to about 1,525 million pounds annually.

The other large growth sector will be in herring fishmeal and oil. The rate of expansion in Canadian production is rapid, and utilization could reach the level of 2.0 billion pounds (landed weight) of herring on the Atlantic coast by 1975. While prices may decline somewhat in the short run in the domestic and United States market, the future for herring fishmeal and oil should generally be firm.

Measured by catch trends in cod and lobster since 1956, Canada's inshore fishery is declining. The impact, however, has been obscured by substantial increases in landed value per pound for these species. As a result, landed values per man-year have not declined - despite an actual increase in men and gear, particularly in Newfoundland. Nevertheless, productivity and income per fisherman remain extremely low in the inshore fishery, and unemployment and underemployment high. To meet minimum income objectives, given the limited nature of the resource, will require an over-all reduction in the number of inshore fishermen from 41,000 in 1965 to about 17,500 in 1975.

In contrast to the inshore fishery, landed values per fisherman in the Atlantic offshore fishery are high, averaging \$7,300 in 1964. This compares with an inshore average in that year ranging from \$810 in Newfoundland to about \$2,100 in Nova Scotia. The future development of the primary fishery will probably take the form of emphasis on the offshore fishery with increased effort on those species now underutilized. This will enable some shifts of excess manpower from inshore waters. However, the total number of men required, even to treble or quadruple the size of the offshore fleet, is relatively small in terms of the total number of fishermen available.

With respect to groundfish, the regional target for 1975 as suggested by the market forecast is a catch of 830,000 metric tons (round fresh weight). Assuming the inshore contribution to be of the order of 200,000 metric tons, the offshore

catch required to meet the target will be about 630,000 metric tons. This represents an increment (by 1975) of 305,000 metric tons over the 1965 catch. To fulfill it would mean that Canada's share of the total international catch in the areas and for the species which it now fishes would have to increase from 38 per cent to about 55 per cent in 1975 (based on the 1965 total catch in ICNAF Subareas 3, 4 and 5).

There is no doubt that sufficient resources exist to permit expansion to this level for the North Atlantic fisheries as a whole. And, although international competition in the North Atlantic fisheries is heavy, Canada continues to "outfish" her competitors, on a vessel-to-vessel comparison, in terms of both catch per day and catch per man. Nevertheless, for all nations there is a clear trend toward declining catch per unit of effort.

Of significance also is the contraction in the area of the Canadian catch. Canada has become increasingly dependent on the Laurentian Bight,1/ while losing ground in the fishing areas to the north and east of Newfoundland (ICNAF Divisions 3K, 3L and 3M).

With respect to fish landings and processing, there is some indication of a trend toward increasing concentration in certain ports. However, our analysis suggests that the location of much such concentration has not necessarily been where the greatest economic benefit could be gained. The present differential in primary product prices paid in different landing areas would - under free market conditions - lead fishing vessel operators to land their catches at those ports where they would bring the highest price. However, because of the structure of the industry, whereby vessels are tied to specific plants and ports, this does not happen. Thus, vertical integration in fishing and processing (while it has been beneficial in many respects) clearly inhibits rationalization of the industry.

A comparison by province of the economic performance of fish-processing plants demonstrates that benefits accruing to primary fishermen, processing employees, plant owners and the regional economy from landing and processing fish are greatest in those locations which have greatest access to the markets for high-value end-products.

Size of firm is important as well. It is the larger firms which create the greater value added per man-hour or per dollar of wages. It is the larger firms which are best able to (and do) pay higher wages to their workers. The conclusion is inescapable, that the benefits to the region will be greater if future increases in production take place in a relatively small number of large fish-processing plants.

Looking to the future, there is little that can be done about the decline in the catch per unit of effort, but the other trends, since they are under Canadian control, are subject to modification.

1/ See Figure 6-6.

It is clear, however, from fisheries company intentions that emphasis on additional catching capacity will continue to be directed to Southern Newfoundland and Eastern Nova Scotia. This is an undesirable trend, since it will tend to further concentrate fishing effort in the Laurentian Bight at the expense of the grounds to the north and south, and will land catches in ports where fish prices are low.

If it is assumed that the prevailing type of fishing vessel in the future will not have freezing-at-sea capacity, thus limiting its effective working radius to about 300 miles, then the implications of this study would seem to call for Atlantic fisheries development along the following lines:1/

1. Gulf: No expansion in groundfish capacity. The objective should be to rationalize the fishery by concentrating landings in one location, Shippegan-Caraquet. Expansion of underdeveloped fisheries such as crab and fishmeal is warranted, but it should make use of existing underutilized plant capacity rather than lead to the establishment of additional plants.

2. Eastern Nova Scotia and Southern Newfoundland: Additions to processing capacity should not be encouraged. However, existing plants should be encouraged to obtain more vessels to enable their rate of utilization to be increased. Rationalization of capacity in the Canso Strait area of Nova Scotia and on the Burin Peninsula in Southern Newfoundland should be encouraged.

3. Fundy, Western Nova Scotia and Eastern Newfoundland: Additional capacity should be encouraged to locate in these areas. In Fundy and Western Nova Scotia the objective would be to enable increased effort to be applied in Subarea 5, at present relatively little used by Canada, though it is heavily fished by other nations and the experience of Canadian vessels would seem to indicate a relatively low catch per unit of effort. However, the Fundy and Western Nova Scotia areas also provide the highest landed value per pound for the catch, a position which they probably will retain. Additional new capacity should be located in Eastern Newfoundland to enable the grounds to the north and east of Newfoundland to be exploited.

Where additional capacity is suggested it would be desirable to concentrate the capacity in a single port. In Western Nova Scotia two large-scale groundfish ports already exist, Halifax and Lunenburg. Further expansion at Halifax is probably not desirable because of the conflicts that are beginning to emerge with other, higher-value waterfront uses, and the

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1/ For locations, refer to Figure 6-4, p. 47.

difficulty of finding fish-plant labour in a major metropolitan centre. Lunenburg is an excellent site, the present port for the largest fish-processing plant in Canada, with external economies already available in vessel-repair facilities, electronic services, and a number of other fisheries-oriented service facilities. Unfortunately additional suitable wharfage does not seem to be readily available.

Of the other potential sites in Western Nova Scotia, Yarmouth is handicapped by a limited harbour area and a serious silting problem. Pubnico has already developed a specialized centre for fishmeal production, and the remaining sites should be reserved for future expansion in this phase of the fisheries. Shelburne, which possesses a magnificent natural harbour, surplus naval ship-repair facilities and a location on a major highway and railway route, seems to have the best long-term potential for accommodating additional fish-processing capacity in Western Nova Scotia.

In New Brunswick one major port in Charlotte County should be selected, which would be designated as the major trawler fishing harbour for that coast. A study is currently underway which will assist in the identification of the most suitable site.

In Eastern Newfoundland, Harbour Grace would seem to be best suited to develop the role of major trawler harbour. Farther north along this coast, ice conditions become increasingly difficult, preventing year-round operation. However, because of its location with respect to Subarea 2, St. Anthony (or some other far northern port) should be examined carefully to see whether its locational advantage for prosecuting this underutilized fishery compensates for the disadvantages of ice conditions and distance from markets.

The preceding discussion applies only to major trawler harbours. A number of minor fishing ports will also be required to service the inshore fishery, particularly the lobster fishery. Their number will certainly be fewer than now exist, but their selection will require detailed examination of their roles, spacing, facilities and functions.

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TABLE A-1

Landings by Species Group by Province,
Atlantic Provinces, 1956-1965

Year and Species Group	Nfld.	N.S.	N.B.	P.E.I.
	---------	000,000 lbs.	--------	
1965				
Groundfish	522.4	379.0	81.5	22.7
Pelagic & Estuarial	41.3	172.4	198.8	11.4
Molluscs & Crustaceans	21.7	39.3	8.8	12.1
1964				
Groundfish	494.2	350.3	74.6	21.4
Pelagic & Estuarial	33.7	129.8	166.1	8.2
Molluscs & Crustaceans	27.7	37.8	9.5	11.4
1963				
Groundfish	523.6	301.1	75.1	21.1
Pelagic & Estuarial	33.5	189.4	146.5	6.5
Molluscs & Crustaceans	9.5	38.0	10.2	10.9
1962				
Groundfish	491.8	299.4	69.5	21.9
Pelagic & Estuarial	29.3	99.8	119.0	4.3
Molluscs & Crustaceans	5.2	35.4	10.8	11.4
1961				
Groundfish	432.4	293.8	67.0	19.9
Pelagic & Estuarial	28.5	112.6	64.7	3.7
Molluscs & Crustaceans	23.7	32.0	12.2	13.1
1960				
Groundfish	497.4	307.6	66.9	23.3
Pelagic & Estuarial	32.9	90.9	145.6	5.7
Molluscs & Crustaceans	15.7	29.2	13.3	13.3
1959				
Groundfish	492.9	310.5	70.5	22.4
Pelagic & Estuarial	31.8	83.0	139.9	7.4
Molluscs & Crustaceans	10.1	28.4	12.2	12.2
1958				
Groundfish	386.7	319.9	66.4	20.7
Pelagic & Estuarial	53.1	123.9	78.7	7.4
Molluscs & Crustaceans	6.3	22.9	12.1	10.9
1957				
Groundfish	487.1	329.7	63.1	20.5
Pelagic & Estuarial	50.6	83.1	106.9	7.7
Molluscs & Crustaceans	10.0	24.0	15.1	11.4
1956				
Groundfish	507.8	338.5	77.4	21.3
Pelagic & Estuarial	62.9	73.6	91.9	7.6
Molluscs & Crustaceans	22.0	27.3	17.5	13.0

Source: Economics Branch, Canada Department of Fisheries.

TABLE A-2

Total Landed Value for All Fisheries, by Provinces, Maritimes, 1940-1965

Year	N.S.	N.B.	P.E.I.	Maritimes
	$	$	$	$
1940	5,800,297	2,028,399	553,620	8,382,316
1941	6,930,065	2,827,551	758,464	10,516,080
1942	8,874,850	3,649,340	1,148,367	13,672,557
1943	12,827,765	5,192,472	1,869,266	19,889,503
1944	14,850,800	5,403,571	1,797,200	22,051,571
1945	19,223,404	5,477,452	2,309,147	27,010,003
1946	20,559,604	7,145,383	3,085,485	30,790,472
1947	15,155,600	5,995,606	1,880,100	23,031,306
1948	19,070,900	7,884,800	2,201,100	29,156,800
1949	18,690,900	6,437,200	2,055,200	27,183,300
1950	21,399,500	6,791,600	2,556,000	30,747,100
1951	21,398,000	7,588,300	2,239,700	31,226,000
1952	22,679,300	7,825,000	2,660,200	33,164,500
1953	21,928,400	6,910,400	2,869,900	31,708,700
1954	23,046,000	7,310,500	2,948,400	33,304,900
1955	23,582,000	6,753,300	3,279,100	33,614,400
1956	25,038,400	8,146,300	3,948,700	37,133,400
1957	23,083,800	7,013,800	3,549,800	33,647,400
1958	24,954,500	7,498,600	3,754,400	36,207,500
1959	27,111,500	8,763,300	4,286,500	40,161,300
1960	26,094,400	9,357,600	4,639,600	40,091,600
1961	27,712,300	7,625,300	4,487,300	39,779,400
1962	30,844,700	8,882,600	4,361,500	44,088,800
1963	35,080,800	9,184,000	4,447,500	48,712,300
1964	40,952,300	10,167,200	5,642,000	56,761,500
1965	48,135,200	10,455,900	6,827,800	65,418,900

Source: Economics Branch, Canada Department of Fisheries.

TABLE A-3

Monthly Groundfish Landings by Province, Atlantic Provinces, 1965

	Total	Nfld.	N.S.	N.B.	P.E.I.
	000 lbs.				
January	25,258	10,571	13,901	778	8
February	42,234	19,295	21,724	1,214	1
March	54,593	21,644	31,529	1,420	-
April	58,835	24,176	32,855	1,804	-
May	84,155	29,596	42,696	11,029	834
June	131,886	78,524	37,958	12,625	2,779
July	166,696	113,272	36,504	13,627	3,293
August	138,552	76,756	44,791	11,125	5,880
September	109,399	60,845	34,056	10,948	3,550
October	77,627	35,066	28,403	11,113	3,045
November	56,347	21,119	28,945	4,857	1,426
December	49,328	18,684	26,106	1,383	3,155

Source: Economics Branch, Canada Department of Fisheries.

TABLE A-4

Average Monthly Landings by Vessels Over 70 Feet in Length, Maritimes and Newfoundland, 1963-65

Month	Average Landings		
	Maritimes	Newfoundland	Total
	000 lbs.		
January	12,470	7,456	19,926
February	16,838	10,039	26,877
March	24,263	13,205	37,468
April	23,316	14,806	38,122
May	26,055	17,619	43,674
June	22,173	17,262	39,435
July	18,426	14,248	32,674
August	19,228	14,525	33,753
September	17,989	14,005	31,994
October	17,985	14,837	32,822
November	19,254	13,559	32,813
December	21,142	10,359	31,501
Total	79,713	53,973	133,686

Source: Economics Branch, Canada Department of Fisheries.

TABLE A-5

Number of Men Engaged in Primary Fishing, Maritime Provinces 1923-65, Newfoundland 1954-65

	N.B.	P.E.I.	N.S.	Nfld.	Region
1923	8,788	2,503	16,742		
1924	8,307	2,537	15,805		
1925	8,490	3,017	16,266		
1926	8,589	2,916	16,315		
1927	9,701	2,675	16,131		
1928	10,596	2,396	15,857		
1929	11,512	2,202	15,747		
1930	11,599	2,281	15,265		
1931	12,318	2,431	15,527		
1932	12,874	3,018	16,258		
1933	11,789	3,194	17,133		
1934	12,525	2,973	18,448		
1935	12,598	3,365	17,907		
1936	13,805	3,093	18,359		
1937	13,491	3,310	18,088		
1938	13,713	3,309	18,548		
1939	13,366	3,454	17,548		
1940	12,030	2,874	17,590		
1941	10,859	2,445	15,149		
1942	10,110	2,267	13,452		
1943	9,805	2,172	13,370		
1944	10,032	2,269	13,863		
1945	10,404	2,410	14,413		
1946	10,693	2,960	15,860		
1947	11,073	3,307	14,475		
1948	10,973	3,046	14,915		
1949	11,040	2,909	14,896		
1950	11,621	2,895	15,723		
1951	11,201	2,660	15,607		
1952	10,109	2,665	15,248		
1953	10,198	2,763	14,614		
1954	9,209	2,794	14,864	16,314	43,181
1955	9,634	2,863	14,221	16,000*	42,718
1956	9,399	2,967	14,379	14,956	41,701
1957	7,815	3,000	15,224	16,469	42,508
1958	6,060	3,209	13,747	18,364	41,380
1959	6,211	3,260	13,012	18,430	40,913
1960	6,012	3,274	12,780	18,291	40,347
1961	6,083	3,464	12,578	18,756	40,881
1962	6,016	3,367	12,711	19,817	41,911
1963	5,833	3,372	13,467	21,407	44,079
1964	5,790	3,329	13,333	22,615	45,067
1965	6,101	3,567	14,052	21,701	45,421

* Estimated.

Source: Economics Branch, Canada Department of Fisheries.

TABLE A-6

Number of Men Employed in Primary Fishing Operations, Maritime Provinces 1961, 1965

	N.B.		P.E.I.		N.S.		Total	
	1961	1965	1961	1965	1961	1965	1961	1965
Full Time	534	302	10	42	3,331	4,474	3,875	4,818
Part Time	2,433	2,494	2,298	2,028	4,668	4,830	9,399	9,352
Occasional	3,116	3,305	1,156	1,497	4,579	4,748	8,851	9,550
Alewives	325	213	179	22	568	547	1,072	782
Clams	285	320	39	112	139	112	463	544
Groundfish	2,385	2,041	1,602	924	6,768	7,214	10,755	10,179
Herring	3,214	2,940	1,425	1,438	4,179	3,920	8,818	8,298
Lobster	4,204	4,291	2,810	3,043	9,423	10,739	16,487	18,073
Mackerel	695	927	1,403	803	2,756	2,574	4,854	4,304
Oysters	17	286	541	636	198	214	756	1,136
Salmon	650	787	1	6	633	663	1,284	1,456
Scallops	33	79	3	78	545	1,033	581	1,190
Smelts	1,066	722	245	181	310	279	1,621	1,182
Swordfish	1	-	-	-	966	928	967	928
Other	591	554	608	345	1,121	948	2,320	1,847

Note: Full Time = 10 months or more; Part Time = 5 to 10 months; Occasional = less than 5 months.

Source: Economics Branch, Canada Department of Fisheries.

TABLE A-7

Number of Men, Motor Boats and Vessels by Statistical District or Area, Atlantic Provinces, 1965

Statistical District	No. Fishermen	Boats Under 10 Tons	Vessels Over 10 Tons
Nova Scotia			
1	494	264	9
2	402	126	28
3	308	164	-
4	179	90	1
6	724	203	15
7	687	260	43
8	189	106	3
9	308	156	21
11	374	183	1
12	206	76	-
13	304	166	5
14	186	51	77
15	443	239	6
16	104	76	1
17	253	139	22
19	405	267	2
20A	192	133	1
20B	72	22	4
21	455	-	25
22	371	160	22
23	263	137	2
24	339	188	1
26	818	126	49
27	250	139	3
28	403	174	31
30	399	142	40
31	482	223	65
32	1,078	365	333
33	940	302	168
34	554	102	145
36	299	84	51
37	425	174	64
38	153	23	15
39A	296	45	38
39B	72	45	-
40A	62	24	-
40B	60	10	2
42	65	-	-
43A	58	4	-
43B	45	22	-
44A	50	30	1
44B	23	11	-
45	228	156	-
46	163	107	-
New Brunswick			
48	70	53	4
49	206	124	-
50	421	87	135
51	335	135	83
52	71	41	11
53	259	146	53
63	181	53	-
64	155	104	1
65	426	205	40
66	561	205	49
67	208	47	27
68	135	47	11
70	376	142	30
71	143	18	2
72	96	19	-
73	336	49	97
75	393	137	60
76	295	84	90
77	489	175	32
78	319	101	70
79	33	19	-
80A	550	165	93
80B	43	19	1
Prince Edward Island			
82A	519	225	1
82B	485	226	5
83A	319	135	-
83B	337	195	2
85A	89	45	-
85B	150	86	3
86A	154	74	-
86B	131	51	1
87A	638	356	9
88	745	313	16
Newfoundland			
A	1,860	1,262	11
B	3,659	2,633	32
C	1,960	1,106	30
D	1,847	781	18
E	1,747	589	24
F	1,473	492	10
G	647	265	14
H	1,888	1,011	36
I	945	350	26
J	1,195	489	50
K	552	250	-
L	590	398	4
M	543	413	4
N	852	600	9
O	1,943	934	2

Source: Economics Branch, Canada Department of Fisheries.

TABLE A-8

Summary of Short-Term Forecasts, Catch and Effort, 1963-68

	Fishing Effort (Conventional Trawler)							Catch (Round Fresh Weight)					
	1963	1964	1965	1966	1967	1968		1963	1964	1965	1966	1967	1968
	-------- 000,000 ton-hours -------							------------- 000 tons -----------					
COD													
Barents Sea	75	75	75	75	75	?		65	51	37	38	45	?
Bear Island	44	50	55	60	65	70		43	48	41	34	41	53
Norway Coast	29	30	30	30	30	30		19	15	14	12	12	10
Iceland	203	200	200	200	200	200		121	120	120	120	120	120
W. Greenland	18	18	20	23	26	29		27	23	26	30	23	26
Labrador								+					
Newfoundland	9	14	18	22	26	30		12	20	25	30	35	42
HADDOCK													
Barents Sea								10	14	19	24	16	?
Norway Coast								9	9	7	7	9	7
Iceland								39	36	36	34	34	32
TOTAL EFFORT	378	387	398	410	422	434	Total cod & haddock	344	336	325	329	335	(355)
							Total all species	406	396	383	388	395	419

Source: Great Britain Ministry of Agriculture, Fisheries and Food. Future prospects in the distant-water fisheries. Laboratory leaflet (new series) no. 8. Fisheries Laboratory, Lowestoft, May 1965.

TABLE A-9

Days Fished, Hours Fished, Total Catch, Catch Per Hour and Day
For Subareas 3, 4, 5, Newfoundland and Mainland,
151-500 Ton Otter Trawler Class, 1955

Division	Mainland					Newfoundland				
	Days Fished	Hours Fished	Total Catch	Catch Per Day	Catch Per Hour	Days Fished	Hours Fished	Total Catch	Catch Per Day	Catch Per Hour
			----- metric tons		-------			------ metric tons		-----
3K	-	-	-	-	-	1	1	1	1	1
3L	597	7584	9670	16.19	1.27	573	5971	8022	14.00	1.34
3M	-	-	-	-	-	-	-	-	-	-
3N	125	1633	1564	12.51	.95	205	1646	1988	9.69	1.20
3O	358	3644	4218	11.78	1.15	216	1756	3186	14.75	1.81
3P	657	6308	9795	14.90	1.55	1350	11883	24298	17.99	2.04
3NK*	-	-	-	-	-	-	-	-	-	-
4R	315	3402	3676	11.66	1.08	202	2274	3510	17.37	1.54
4S	191	2288	3006	15.73	1.31	60	718	933	15.55	1.29
4T	342	3875	3074	8.98	.79	38	391	289	7.61	.73
4V	442	4994	4740	10.72	.94	50	611	511	10.22	.83
4W	1674	20107	17526	10.46	.87	-	-	-	-	-
4X	25	233	304	12.16	1.30	-	-	-	-	-
5Y	-	-	-	-	-	-	-	-	-	-
5Z	2841	37892	26495	9.32	.69	-	-	-	-	-

* Subarea 3, Division not known.

Source: ICNAF Statistical Bulletin, v.5. 1955.

TABLE A-10

Days Fished, Hours Fished, Total Catch, Catch Per Hour and Day For Subareas 3, 4, 5, Newfoundland and Mainland, 151-500 Ton Otter Trawler Class, 1960

Division	Mainland					Newfoundland				
	Days Fished	Hours Fished	Total Catch	Catch Per Day	Catch Per Hour	Days Fished	Hours Fished	Total Catch	Catch Per Day	Catch Per Hour
			------ metric tons -------					------ metric tons ------		
3K	1	13	5	5.00	.38	1	2	1	1.00	.50
3L	574	7,802	8,481	14.77	1.08	1,003	12,168	12,018	11.98	.98
3M	-	-	-	-	-	-	-	-	-	-
3N	119	1,576	1,213	10.19	.76	523	6,168	5,757	11.00	.93
3O	430	5,461	6,121	14.23	1.12	1,184	14,549	17,506	14.78	1.20
3P North	-	-	-	-	-	3	19	18	6.00	.94
3P South	667	8,580	8,037	12.04	.93	729	8,818	5,912	8.10	.67
3NK*	-	-	-	-	-	-	-	-	-	-
4R	571	7,422	7,382	12.92	.99	167	2,108	1,495	8.95	.70
4S	213	2,579	1,483	6.96	.57	16	184	99	6.18	.53
4T	202	2,541	1,411	6.98	.55	18	268	129	7.16	.48
4V North	313	4,056	3,158	10.08	.77	-	-	-	-	-
4V South	344	5,149	4,020	11.68	.78	2	20	13	6.50	.65
4W	2,978	41,064	32,277	10.83	.78	-	-	-	-	-
4X	-	-	-	-	-	-	-	-	-	-
5Y	-	-	-	-	-	-	-	-	-	-
5Z	16	256	101	6.31	.39	-	-	-	-	-

* Subarea 3, Division not known.

Source: ICNAF Statistical Bulletin, v.10. 1960.

TABLE A-11

Days Fished, Hours Fished, Total Catch, Catch Per Hour and Day
For Subareas 3, 4, 5, Newfoundland and Mainland,
151-500 Ton Otter Trawler Class, 1965

Division	Mainland					Newfoundland				
	Days Fished	Hours Fished	Total Catch	Catch Per Day	Catch Per Hour	Days Fished	Hours Fished	Total Catch	Catch Per Day	Catch Per Hour
			------ metric tons ------					------ metric tons ------		
3K	22	317	297	13.50	.93	2	3	1	.50	.33
3L	432	5,447	6,068	14.04	1.11	1,053	15,266	14,721	13.90	.96
3M	-	-	-	-	-	-	-	-	-	-
3N	423	5,979	5,554	13.10	.92	1,932	26,764	23,660	12.24	.88
3O	3	63	25	8.30	.39	369	4,847	4,254	11.50	.87
3P North	4	25	70	17.50	2.80	854	8,694	9,263	10.80	1.06
3P South	248	3,342	2,521	10.10	.75	983	10,391	9,273	9.43	.89
3NK *	-	-	-	-	-	-	-	-	-	-
4R	168	2,245	1,983	11.80	.88	608	7,079	7,576	12.46	1.07
4S	439	5,245	4,855	11.05	.92	153	1,815	2,206	14.41	1.21
4T	803	8,748	4,456	5.54	.50	245	2,883	2,728	11.13	.95
4V North	829	10,380	9,229	11.10	.89	583	6,630	7,617	13.06	1.14
4V South	1,016	12,111	11,730	11.54	.96	240	3,011	3,682	15.30	1.22
4W	2,678	32,499	30,068	11.22	.92	3	37	27	9.00	.72
4X	2,528	31,931	22,467	8.88	.70	-	-	-	-	-
5Y	-	-	-	-	-	-	-	-	-	-
5Z	2,841	37,892	26,495	9.32	.69	-	-	-	-	-

* Subarea 3, Division not known.

Source: ICNAF Statistical Bulletin, v.15. 1965.

TABLE A-12

Groundfish Catch* (round fresh weight), by Divisions of Subareas 2, 3, 4 and 5, 1955

Div.	Total Catch (All Countries)	% of Total Catch by Divisions	Canada Mainland	% of Mainland Catch by Divisions	Canada Nfld.	% of Nfld. Catch by Divisions	Canada as % of Total Catch	Inshore Catch	Total Off-shore Catch (All Countries)	Canada as % of Total Offshore
	metric tons	%	metric tons	%	metric tons	%	%	metric tons	metric tons	%
3K	81,495	6.90	-	-	59,675	23.43	73.22	59,241	22,254	0.53
3L	170,108	14.42	18,881	8.30	93,464	36.70	66.03	85,188	84,920	15.96
3M	792	0.06	-	-	-	-	-	-	792	-
3N	117,683	9.98	1,786	0.78	1,999	0.78	3.20	-	117,683	3.20
3O	61,523	5.21	6,843	3.01	3,238	1.27	16.38	-	61,523	16.38
3P	141,684	12.01	23,080	1.01	64,695	25.41	61.94	30,528	111,156	40.40
4R	85,646	7.20	4,869	2.14	19,247	7.56	28.15	15,656	69,990	9.87
4S	14,057	1.19	8,845	3.89	933	0.36	69.55	-	14,057	69.55
4T	62,767	5.32	60,404	26.58	292	0.11	96.69	23,792	38,975	58.79
4V	54,727	4.64	19,791	8.71	560	0.21	33.18	8,527	46,200	21.60
4W	41,699	3.53	35,933	15.81	-	-	86.17	11,025	30,674	59.73
4X	62,401	5.29	46,251	20.35	-	-	74.11	41,320	21,081	7.90
5Y	105,842	8.97	484	0.21	-	-	0.45	-	105,842	0.45
5Z	152,905	12.96	42	0.02	-	-	0.02	-	152,905	0.02
2G	12	‡	-	-	12	‡	100.00	-	12	-
2H	753	0.06	-	-	731	0.28	97.08	-	758	-
2J	25,076	2.12	-	-	9,758	3.83	38.91	9,758	15,318	-
Total	1,179,170	100.00	227,209	100.00	254,604	100.00		285,035	894,135	

* Excluding species not sought by Canada: silver hake, summer flounder, scup, ocean pout, white hake, tile fish.

‡ Less than 0.01 per cent.

Note: Percentages may not add to 100 due to rounding.

Source: ICNAF Statistical Bulletin, vol.5. 1955.

TABLE A-13

Groundfish Catch* (round fresh weight), by Divisions of Subareas 2, 3, 4 and 5, 1960

Div.	Total Catch (All Countries)	% of Total Catch by Divisions	Canada Mainland	% of Mainland Catch by Divisions	Canada Nfld.	% of Nfld. Catch by Divisions	Canada as % of Total Catch	Inshore Catch	Total Off-shore Catch (All Countries)	Canada as % of Total Offshore
	metric tons	%	metric tons	%	metric tons	%	%	metric tons	metric tons	%
3K	141,389	10.90	53	0.02	47,718	18.86	33.78	47,702	93,687	‡
3L	192,463	14.93	11,166	4.76	108,996	42.38	62.43	92,655	99,808	14.29
3M	9,647	0.74	-	-	-	-	-	-	9,647	-
3N	51,096	3.96	1,718	0.73	5,893	2.29	14.89	-	51,096	14.89
3O	62,818	4.87	6,888	2.93	-	-	10.96	-	62,818	10.96
3Pn	11,493	0.89	3	‡	5,346	2.07	46.53	3,803	7,690	13.45
3Ps	94,175	7.30	10,109	4.31	48,763	18.96	72.50	40,138	54,037	19.89
3P	105,668	8.19	10,112	4.31	54,109	21.04	60.76	43,941	61,727	19.18
4R	73,815	5.72	10,316	4.39	19,137	7.44	39.89	17,186	56,629	16.61
4S	22,923	1.77	22,002	9.38	154	0.05	96.65	-	22,923	96.65
4T	62,781	4.87	57,190	24.38	263	0.10	91.51	22,397	40,384	55.83
4Vn	40,010	3.10	13,859	5.91	17	‡	34.68			
4Vs	41,521	3.22	5,506	2.34	26	0.01	13.32			
4V	81,531	6.32	19,365	8.25	43	0.01	23.80	2,710	78,821	20.48
4W	68,965	5.35	48,999	20.89	-	-	71.04	2,313	66,652	67.69
4X	66,338	5.14	42,052	17.93	-	-	63.39	10,989	55,349	46.82
5Y	30,169	2.34	4,539	1.93	-	-	15.04	-	30,169	15.04
5Z	84,577	6.56	96	0.04	-	-	0.11	-	84,577	0.11
2G	278	0.02	-	-	-	-	-	-	278	-
2H	8,157	0.63	-	-	1,273	0.49	15.60	-	8,157	0.49
2J	226,067	17.54	-	-	15,419	5.99	6.82	12,439	213,628	1.31
Total	1,288,682	100.00	234,496	100.00	253,005	100.00		252,332	1,036,350	

* Excluding species not sought by Canada: silver hake, summer flounder, scup, ocean pout, white hake, tile fish.

‡ Less than 0.01 per cent.

Note: Percentages may not add to 100 due to rounding.

Source: ICNAF Statistical Bulletin, vol.10. 1960.

TABLE A-14

Groundfish Catch* (round fresh weight), by Divisions of Subareas 2, 3, 4 and 5, 1965

Div.	Total Catch (All Countries)	% of Total Catch by Divisions	Canada Mainland	% of Mainland Catch by Divisions	Canada Nfld.	% of Nfld. Catch by Divisions	Canada as % of Total Catch	Inshore Catch	Total Off-shore Catch (All Countries)	Canada as % of Total Offshore
	metric tons	%	metric tons	%	metric tons	%	%	metric tons	metric tons	%
3K	95,845	5.18	297	0.10	28,915	9.42	30.46	24,573	71,272	4.84
3L	230,731	12.47	4,965	1.70	85,536	27.87	39.27	74,415	156,316	6.97
3M	93,296	5.04	-	-	27	‡	0.03	-	93,296	0.03
3N	77,490	4.18	5,949	2.03	59,976	19.54	85.06	-	77,490	85.06
30	84,593	4.57	118	0.04	4,385	1.42	5.32	-	84,593	5.32
3Pn	26,013	1.40	149	0.05	17,104	5.57	66.32			
3Ps	64,699	3.49	2,900	0.99	38,872	12.66	64.56			
3P	90,712	4.90	3,049	1.04	55,976	18.23	65.06	39,655	51,057	21.35
4R	67,394	3.64	6,222	2.13	27,065	8.81	49.38	16,970	50,424	15.90
4S	33,203	1.79	24,884	8.52	2,262	0.73	81.71	-	33,203	81.71
4T	74,452	4.02	69,055	23.64	4,059	1.32	98.20	11,456	62,996	82.81
4Vn	37,985	2.05	20,433	6.99	7,996	2.60	74.84			
4Vs	54,360	2.93	16,508	5.65	3,883	1.26	37.50			
4V	92,345	4.99	36,941	12.65	11,879	3.87	52.86	3,548	88,797	49.02
4W	133,048	7.19	42,183	14.44	27	‡	31.72	5,120	127,928	27.87
4X	85,181	4.60	69,251	23.71	-	-	81.29	22,722	62,459	54.62
5Y	23,401	1.26	362	0.12	-	-	1.54	-	23,401	1.54
5Z	337,769	18.26	28,739	9.84	-	-	8.50	-	337,769	8.50
2G	9,455	0.51	-	-	2	‡	-	-	9,455	-
2H	44,517	2.40	-	-	1,232	0.40	2.40	1,232	43,285	-
2J	276,643	14.95	-	-	25,562	8.32	14.95	25,562	251,081	-
Total	1,850,075	100.00	292,015	100.00	306,903	100.00		225,253	1,624,822	

* Excluding species not sought by Canada: silver hake, summer flounder, scup, ocean pout, white hake, tile fish.

‡ Less than 0.01 per cent.

Note: Percentages may not add to 100 due to rounding.

Source: ICNAF Statistical Bulletin, vol.15. 1965.

TABLE A-15

Net Value of Production in Commodity-Producing Industries, and Percentage Analysis, Atlantic Provinces, 1960, 1963 and 1965

Industry	Nova Scotia		New Brunswick		P.E.I.		Newfoundland	
	$000	%	$000	%	$000	%	$000	%
1 9 6 0								
Agriculture	27,385	6.4	35,773	10.4	19,348	39.0	-	-
Fisheries	26,094	6.1	9,358	2.7	4,640	9.4	15,856	6.6
Forestry	15,409	3.6	34,926	10.1	653	1.3	28,172	11.7
Trapping	115	0.1	104	0.1	-	-	80	-
Mining	45,289	10.6	7,935	2.3	72	0.1	49,053	20.3
Electric Power	23,515	5.5	18,692	5.4	2,079	4.2	10,338	4.3
Manufactures	171,493	40.2	154,697	44.8	8,026	16.2	63,490	26.3
Construction	117,541	27.5	83,428	24.2	14,764	29.8	74,455	30.8
Total	426,842	100.0	344,913	100.0	49,581	100.0	241,446	100.0
1 9 6 3								
Agriculture	24,877	5.6	23,355	6.6	13,665	25.8	-	-
Fisheries	36,644	8.2	9,353	2.6	4,630	8.8	20,429	6.6
Forestry	12,610	2.8	38,307	10.8	492	0.9	19,654	6.4
Trapping	100	-	221	0.1	1	-	59	-
Mining	45,808	10.3	11,666	3.3	296	0.6	79,600	25.9
Electric Power	28,515	6.4	24,473	6.9	2,696	5.1	15,441	5.0
Manufactures	188,064	42.2	169,640	47.8	10,621	20.1	74,001	24.1
Construction	109,095	24.5	77,617	21.9	20,454	38.7	98,435	32.0
Total	445,712	100.0	354,632	100.0	52,855	100.0	307,619	100.0
1 9 6 5								
Agriculture	30,259	5.8	37,339	7.9	23,482	34.8	-	-
Fisheries	49,372	9.4	10,672	2.2	7,083	10.5	24,111	6.4
Forestry	8,101	1.5	27,777	5.8	-	-	21,260	5.6
Trapping	170	-	254	0.1	1	-	87	-
Mining	47,077	9.0	47,162	9.9	296	0.4	122,767	32.4
Electric Power	30,740	5.9	29,500	6.2	3,123	4.6	21,364	5.6
Manufactures	222,662	42.5	196,237	41.2	12,724	18.8	82,407	21.7
Construction	136,028	25.9	126,864	26.7	20,902	30.9	107,106	28.3
Total	524,409	100.0	475,086	100.0	67,611	100.0	379,102	100.0

Source: Survey of Production 1963, 1965. D.B.S.

TABLE A-16

Employment in Fish Processing,
Atlantic Provinces, 1965

Province	All Employees			Production Employees		
	Male	Female	Total	Male	Female	Total
Newfoundland	3,333	698	4,031	3,012	623	3,635
P.E.I.	275	241	516	232	228	460
Nova Scotia	3,435	1,309	4,744	3,029	1,163	4,192
New Brunswick	1,417	1,244	2,661	1,221	1,178	2,399
Total	8,460	3,492	11,952	7,494	3,192	10,686

Source: Fish Products Industry 1965. D.B.S.

TABLE A-17

Approximate Annual Landings at Major Fishing Harbours, Atlantic Provinces, 1965

Harbour	Approximate Landings
	000,000 lbs.
Lunenburg	62
Halifax	58
Blacks Harbour	50
Harbour Breton	40
Fortune	36
Grand Bank	35
Burin	30
Petit de Grat	30
Louisbourg	30
Shippegan	29
Mulgrave	28
Lower East Pubnico	27
Lockeport	25
Burgeo	23
St. Johns	22
Caraquet	22
Woods Harbour	20
Beaver Harbour	20
Yarmouth	19
Harbour Grace	19
Ramea	18
North Sydney	18
Westport	16
Souris	15
Canso	14
Isle aux Morts	13
Lameque	12
Gaulfois	11
Glace Bay	11
Wedgeport	10
Bickerton	10

Source: Economics Branch, Canada Department of Fisheries.

TABLE A-18

Annual Fish Landings at Selected Harbours, 1961-1965

Harbour	1965	1964	1963	1962	1961
	----	----	000 lbs.	----	----
Cheticamp	7,834	8,207	8,066	5,974	6,281
North Sydney	17,773	13,309	9,199	5,725	5,131
Glace Bay	10,810	8,163	11,645	10,328	9,863
Alder Point	1,704	684	585	664	778
Louisbourg	30,796	27,866	22,928	17,588	17,655
Petit de Grat	30,155	30,589	22,714	25,733	27,550
Mulgrave	28,741	27,096	24,877	22,159	20,224
Canso	14,189	14,873	9,842	14,058	15,902
Bickerton West	9,545	8,336	6,205	5,069	5,846
Halifax	54,499	61,082	57,515	61,608	66,845
Lunenburg	62,036	48,411	38,561	37,851	40,454
Port Mouton	1,865	1,895	1,847	1,161	1,414
Shelburne	7,996	6,964	3,677	3,202	3,573
Liverpool	1,516	1,890	1,746	2,763	1,665
Lockeport	24,908	21,979	17,372	18,885	15,896
Yarmouth	19,596	17,273	17,543	15,299	10,662
Clark's Harbour	7,851	6,407	5,371	5,335	5,079
Lr. East Pubnico	26,841	11	1,355	357	149
Digby	6,371	3,887	2,182	4,340	6,391
North Head	19,753	9,347	4,556	9,861	4,934
Wilson's Beach	3,082	9,315	4,012	8,731	3,390
Caraquet	22,348	22,060	20,162	17,484	15,730
Shippegan	29,983	27,293	27,149	22,307	21,504
Lameque	12,164	10,376	11,276	9,182	7,456
Souris	14,837	12,546	12,693	12,201	12,252
Georgetown	2,508	328	222	263	289
Beaver Harbour	20,557	21,378	14,928	17,199	17,585

Source: Economics Branch, Canada Department of Fisheries.

TABLE A-19

Location of Fish-Processing Establishments
Atlantic Provinces

Statistical District	Community	Statistical District	Community
Nova Scotia			
1	Neils Harbour Dingwall Ingonish Beach	22	Sambro Terrence Bay
2	Cheticamp Grand Etang	23	Hubbards
6	North Sydney Alder Point	25	Blandford
7	Glace Bay Main-a-Dieu Port Morien Louisbourg	26	Lunenburg Riverport
9	Petit de Grat	27	Voglers Cove La Have
11	Pictou	28	Port Mouton Liverpool
12	Lismore	30	Lockeport Pleasant Point Little Harbour
14	Mulgrave Aulds Cove	31	Jordan Bay Shelburne Gunning Cove Ingomar Upper Port La Tour Baccaro Port La Tour Port Saxon
15	Canso White Head Queensport	32	South Side The Hawk Clark's Harbour West Head Newellton Woods Harbour Shag Harbour Stoney Island
16	Seal Harbour New Harbour	33	Wedgeport Argyle Lower West Pubnico East Pubnico Middle West Pubnico
17	Marie Joseph Bickerton West		
19	Tangier Moser River		
20A	East Jeddore		
21	Halifax		

TABLE A-19 (cont.)

Statistical District	Community	Statistical District	Community
Nova Scotia (cont.)			
		52	St. Andrews
34	Yarmouth		
	Port Maitland	53	Back Bay
	Short Beach		Beaver Harbour
	Sandford		Blacks Harbour
	Pembroke		
	Yarmouth Bar	64	Green Point
			Petit Rocher
36	New Edinburg		
	Whites Cove	65	Caraquet
	Church Point		Blue Cove
	Comeauville		Grand Anse
	Saulnierville		Maisonette
	Meteghan		Middle Caraquet
	Salmon River		Lower Caraquet
37	Westport	66	Lameque
	Freeport		Island River
	Tiverton		
	East Ferry	67	Shippegan
	Little River		
	Mink Cove	68	Tracadie
	Centreville		
		70	Neguac
38	Digby		Tabusintac
39	Victoria Beach	71	Loggieville
40	Halls Harbour	73	Baie Ste. Anne
			Escuminac
45	Pugwash		
		75	St. Louis Cape
New Brunswick			
		76	Richibucto
49	Saint John		
		77	Cocagne
50	North Head		
	Castalia	78	Shediac
	Woodwards Cove		Lower Cape Bald
	Grand Harbour		Cape Bald
	Ingalls Head		
	Seal Cove	80A	Cape Tormentine
	White Head		
		Prince Edward Island	
51	Campobello		
	Welshpool	82A	Miminegash
	Fairhaven		
	Leonardville	82B	Tignish
	Richardson		Alberton

TABLE A-19 (cont.)

Statistical District	Community	Statistical District	Community
Prince Edward Island (cont.)			
		C	Greenspond
83A	Summerside		Charleston
	Borden		Bonavista
	Abrams Village		Newton
			Valleyfield
83B	Darnley		Badger's Quay
	Kensington		
		D	Hearts Desire
85B	North Rustico		Hants Harbour
	French River		Catalina
			Dildo
86B	Stanhope		Port Union
	Tracadie		Old Perlican
87	Beach Point	E	Carbonear
	Murray Harbour		Harbour Grace
	Georgetown		Port de Grave
	Gaspereaux		Coley's Point
			Cupids
88	Savage Harbour		Brigus
	Red Head		Bay Roberts
	Cable Head		Portugal Cove
	Naufrage		
	North Lake	F	St. John's
	Souris		Ferryland
	Basin Head		Petty Harbour
			Cape Broyle
Newfoundland			Quidi Vidi
			Bay Bulls
A	St. Anthony		Witless Bay
	Englee		Fermeuse
	La Scie		
	Williamsport	G	Trepassey
	Quirpon		St. Mary's
			Branch
B	Twillingate		Point Lance
	Fogo		
	Seldom	H	Kingwell
	Lewisport		St. Brides
	Herring Neck		Burin
	Nippers Harbour		Merasheen
	Change Islands		Harbour Buffett
	Little Bay Islands		
	Moretons Harbour	I	Fortune
	Triton		Grand Bank
	Comfort Cove		Harbour Breton

TABLE A-19 (cont.)

Statistical District	Community	Statistical District	Community
Newfoundland (cont.)			
J	Gaultois		
	Burgeo		
	Ramea		
	Isle aux Morts		
	Rose Blanche		
	Harbour le Cou		
	Margaree		
L	Lark Harbour		
	Benoits Cove		
	Curling		
M	Norris Point		
	Rocky Harbour		
	Sally's Cove		
	Cow Head		
	Daniels Harbour		
	River of Ponds		
	Port Saunders		
N	Port au Choix		
	Brig Bay		

Source: Economics Branch, Canada Department of Fisheries.

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Background Study 4

MINERAL RESOURCES in the ATLANTIC PROVINCES

ATLANTIC DEVELOPMENT BOARD

Background Study No. 4

MINERAL RESOURCES

IN THE ATLANTIC PROVINCES

ATLANTIC DEVELOPMENT BOARD

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FOREWORD

This report is the fourth in a series initiated by the Atlantic Development Board to examine important aspects of the economy of the Atlantic Region. It was prepared as a background document for public discussion of regional development policies.

The Atlantic Development Board Act authorizes the Board to prepare "... an overall co-ordinated plan for the promotion of the economic growth of the Atlantic Region." The various studies that the Board has prepared provide the basic facts on which development policies will be formulated. They are being published to contribute to public understanding and discussion of the major policy issues in the economic development of the Atlantic Provinces.

This report is a condensation of three extensive regional studies extending over a period of three years. It was prepared at the request of the Atlantic Development Board by the Mineral Resources Branch, Canada Department of Energy, Mines and Resources, to help the Board assess the contribution that the mineral sector might make to the future economic development of the Atlantic Provinces. A number of factors limit such an appraisal. The resource base has not yet been fully delineated; although minerals and mining have contributed to the economic life of the Atlantic Region for more than two centuries, systematic exploration of the region's mineral potential is far from complete. Mineral discovery, which is a major factor in mineral exploitation, is difficult to predict. While the report takes note of some of the more distant possibilities, it is primarily concerned with developments over the next decade.

The Atlantic Development Board wishes to express its sincere appreciation to the Mineral Resources Branch for the preparation of this report and for the three extensive regional studies on which it is based.

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SUMMARY AND OBSERVATIONS

Between 1964 and 1968, the Mineral Resources Branch of the Department of Energy, Mines and Resources in Ottawa conducted extensive studies into mineral development in the Atlantic Provinces at the request of the Atlantic Development Board and with the agreement and support of each of the three provincial departments of mines. With the co-operation of mining companies, exploration companies, service companies, universities and research establishments, extensive in-depth studies were made into all pertinent aspects of the mineral industry in Newfoundland and Labrador, New Brunswick and Nova Scotia. This report is a condensation and updating of the findings of these studies. The studies were undertaken for the confidential use of the Board and much of the information developed can be presented only in very summary form. The analyses, observations and recommendations were made to assist in appraising the present and future roles of the mineral industry in the economic development of the Atlantic Provinces and also to assist in the identification and timely adjustments of mineral resource management practices in the region. The Atlantic Provinces must compete for both investment capital and mineral sales in the dynamic environment of national and international markets. Therefore, resource management practices in the region should be responsive to changing conditions.

The Regional Mineral Scene

The Atlantic Provinces have a long history of mineral resource development and exploitation. The earliest geological investigations in Canada were conducted in this region, and the first successful and regular mining in Canada also commenced here. At the present time there are over 50 principal mineral producers in the Atlantic Provinces. Their geographic distribution is widespread and in many instances they represent the main economic base of the area in which they are located. The mineral potential of the Atlantic Provinces as a whole is good, but new mineral developments will depend on new discoveries and also on the establishment of new or expanded markets.

The mineral economy of the Atlantic Provinces is export-oriented and there is little possibility of a change in this condition. The iron ore industry is dependent upon markets in Canada and the United States, although there are considerable exports to Europe. The industrial minerals sector is subject to fluctuations in construction activity in the eastern United States. In coal mining, the decline is expected to continue as traditional markets are eroded by alternative energy minerals and as mines become increasingly uneconomic. The outlook for the nonferrous metals sector is for modest expansion that might

be accelerated by economic, fiscal, policy and legislative changes affecting the mineral industry environment. Iron ore will continue to dominate mineral production from the region.

The value of mineral production in the Atlantic Provinces in 1967 was $436.4 million compared with $98 million in 1950 and $11 million in 1900. Of the total 1967 production, the metallics contributed about 72 per cent and the industrial minerals and mineral fuels, about 14 per cent each. In the industrial minerals sector, structural materials accounted for 53 per cent of the sector's output value and nonmetallics, 47 per cent. In 1967 the Atlantic Provinces contributed almost 10 per cent to the total Canadian mineral production value of $4.39 billion.

In 1967, iron ore from Labrador constituted 48.2 per cent of the value of all mineral production in the Atlantic Provinces. Base metals (copper, lead and zinc), including by-product gold, silver and cadmium, accounted for 24.2 per cent of the value of 1967 production. The value of coal production accounted for 13.6 per cent and all other mineral commodities for 14.0 per cent. This latter group includes asbestos, barite, fluorspar, gypsum, peat moss, salt, pyrophyllite, sulphur, quartz, grindstone, cement, clay products, lime, sand and gravel, and stone. Production of natural gas and crude petroleum accounted for less than one tenth of one per cent of the region's total mineral production value.

Mineral production of the Atlantic Provinces, with ready access to ocean transport, is favourably located for low-cost transportation to foreign mineral markets. Historically the United States has been, and continues to be, the principal market for the region's mineral production. Other markets outside Canada include Britain, France, Belgium, the Netherlands, West Germany, Venezuela, Australia and Japan.

In terms of value, the bulk of the mineral production of the Atlantic Provinces is marketed outside the region. This is particularly true with respect to the high-value production of the metallics sector, and to a large degree with respect to nonmetallics production as well. In contrast, production of structural materials, characteristically of low unit value, is marketed almost exclusively within the four provinces. Production from the mineral fuels sector, principally coal, goes to markets in the Atlantic Provinces, Ontario and Québec. In 1967, 54.2 per cent of Nova Scotia's coal production went to markets in Ontario and Québec and 10.9 per cent of New Brunswick's coal production went to markets in Québec. The production of natural gas and crude petroleum, as previously noted, is very minor and is marketed entirely within the region.

Economic activity in the Atlantic Provinces' mining industry is forecast to increase moderately as follows:

	1964 (actual)	1968	1977
Value of Production 1/ (million 1966 $)	256	356	449
Value Added (million 1966 $)	168	233	287
Employment	14,510	16,420	15,690

The decline in over-all employment reflects the expected rationalization of the labour-intensive coal mining industry. Investment totalling about $700 million is expected to be placed in the Atlantic Provinces mining industry during the forecast period.

Although there is a potential for petroleum and natural gas production in offshore areas adjacent to the Atlantic Provinces, and this could begin to be realized in terms of production activity during the forecast period, provision has not been made for such a development within the terms of the above forecast. However, this potential, coupled with other mineral resource potential, is expected to provide a major impetus to investment in mineral exploration through the forecast period.

Because the mineral industry of each province is oriented toward a different commodity sector, significant differences in the present state and outlook exist between the provinces.

Newfoundland and Labrador

The value of production of the mineral industry in the province exceeds that of any other primary industry. Iron ore alone constitutes almost 80 per cent of total mineral production. The huge iron ore reserves in Labrador ensure an adequate resource base for continued production at present or increased rates for an almost indefinite period of time. On the Island, the future would appear to lie in the exploitation of base metals and asbestos. At present, there is no production of energy minerals but considerable efforts are being made in the search for oil and gas in a number of offshore areas. The province can anticipate a period of growth in the mineral industry which, because of the importance of iron ore, will depend to a large extent upon the fortunes of the steel industry in Canada and the United States.

1/ Value of production in the forecast is on the mining-industry basis; value on the mineral-commodity basis is expected to increase from $458 million in 1968 to $582 million in 1977 (compared with $436 million in 1967).

The analysis in Newfoundland and Labrador shows that in order to maximize the benefits to the population of the province and to ensure that the province receives an appropriate and reasonable share of both investment capital and revenue, the implementation of some significant changes in three areas might be considered.

A thorough examination of the economic effects of the present mineral rights disposition policies and practices suggests that the form of legislation that results in large land concessions being given to only a few companies can be considered as one of the causes of slow growth in mineral industry development on the Island. The industry operates under three interrelated handicaps: too few companies are active in exploration; funds available for exploration are inadequate; and far too much land is held in concessions by a very few companies.[1/] The few companies now operating, some of them not primarily in the mining business, do not possess the required capital and know-how necessary to justify their large holding of mineral rights. From the exploration point of view, much favourable ground stands idle.

The analysis also reveals that the taxes levied by the provincial government on the mineral industry in Newfoundland and Labrador appear to be somewhat more lenient than the mining taxes levied by other provinces. However, the complexity of mineral taxation matters warrants a separate study.

The analysis also suggests that studies of the number of mineral industry specialists and the effectiveness of provincial services to the mineral industry are necessary from time to time to ensure that the province provides the services required to facilitate and promote the achievement of provincial development objectives. This applies not only to the type of service but also to its location. For example, it might be advantageous to both government and industry if regional offices were established in areas of intensive mineral industry activity.

New Brunswick

Metallic minerals constitute about three quarters of the total value of mineral production in New Brunswick. All metallic mineral production comes from the Newcastle-Bathurst area. This area is expected to remain the centre of activity for many years and zinc, which currently makes up over 40 per cent of all mineral output, will remain the major product. From present projects and those under development, the province can anticipate a modest growth rate in the metallic sector for many years.

1/ Details are contained in the Report of the Royal Commission on the Economic State and Prospects of Newfoundland and Labrador. St. John's, Queen's Printer, 1967.

The coal mines in the Grand Lake area are recognized as being uneconomic in the face of competition from alternative energy minerals and are to be phased out of production within the next few years.

The province produces a number of industrial minerals which are primarily dependent upon export markets in the United States. Oil and gas have been produced for many years but quantities have been very limited. Offshore oil exploration activity may hold some promise for the future if economic reserves are found.

The analysis deals with several aspects of mineral resource administration. It notes that the establishment of a regional office of the Mines Division of the Department of Natural Resources at Bathurst was an evident success. It suggests that to help achieve the province's objectives for the mineral industry, a policy of setting up branch offices when the need arises is to be encouraged.

The analysis also suggests that regular reviews of provincial government programs for the mining industry might be undertaken in order to maximize their effectiveness and ensure that the programs and the number of staff involved are consistent with the size and growth of the mineral industry in the province.

As in the case of Newfoundland and Labrador, the New Brunswick analysis indicates the desirability of periodically reappraising the requirements of companies in regard to financial or valuation commitments for mineral lands not yet in production so that the optimum level of mineral exploration and development shall be reached.

It would also be useful to re-examine the provincial tax system to ensure that provincial revenues from the mineral industry are comparable with those levied in other Canadian provinces.

Nova Scotia

Coal accounts for about two thirds of the value of mineral production in Nova Scotia with salt and gypsum together constituting a further fifth. Metal mining in the province is of very little importance. Nova Scotia's traditional dependence upon coal mining as the foundation of its mineral economy is now under a considerable strain because the markets for coal both within and outside the province have been eroded by less costly energy mineral alternatives. The coal industry has been supported by federal subventions for many years but present policies will see an organized phasing out of the least economic mines and an inevitable decline in coal mining activity.

The future for industrial minerals is fairly bright and a rise in demand in the present export markets is expected to lead to a modest growth rate. No gas or oil is produced in Nova Scotia but if present offshore exploration activities are successful then an important addition may be made to the economy of the province.

The Government of Nova Scotia maintains good relationships with the mineral industry. In order to maximize the benefits derived from the services given and the revenues received, the Nova Scotia analysis suggests that a continuing examination of the part played by the Department of Mines branch office at Stellarton could lead to greater benefits for both government and industry.

The province has a unique staking system by which claims are located on a map grid based on the National Topographic System. The method appears to be successful, but consideration might be given to the rules governing the shape of blocks of claims. Investigation reveals that the system may not be as effective as it might be in the case of igneous occurrences where mineralization is often narrow but continues on or under the surface for considerable distances.

The future Nova Scotia mineral economy will depend less and less upon coal mining. It is most unlikely that viable mineral industry alternatives will emerge to offset completely the decline in coal. The province may be able to give some further impetus to the already existing industrial mineral industry which is blessed with reserves sufficient to bear an increased rate of exploitation. This will occur only if markets are available, and the analysis indicates that the provincial government may have a role to play in helping to locate new outlets for industrial minerals.

The analysis also suggests that the provincial government might consider certain alterations to the present system of land tenure for industrial minerals, thereby possibly promoting their more rapid development.

MINERAL RESOURCES IN THE ATLANTIC PROVINCES

1. THE MINERAL RESOURCE SETTING

Economic Significance of the Geology of the Atlantic Provinces

The Atlantic Provinces are underlain by a wide variety of rock types ranging in age from Precambrian to Triassic. Labrador, except for a relatively small coastal area running approximately from Battle Harbour southwest to the Québec boundary, is part of the Canadian Shield which is the Precambrian nucleus of the North American Continent. The remaining area, including the Maritimes and the Island of Newfoundland, lies within the Appalachian region of Canada which in turn is part of the larger unit usually referred to as the Appalachian Mountain System which stretches for about 2,000 miles from the State of Alabama in the southwest to the Atlantic Provinces in the northeast.

In the Precambrian of Labrador, five geological structural provinces have been recognized: the Eastern Nain province in two areas along the northeast coast; the Superior province in a small segment of western Labrador; the Churchill province in northwestern Labrador; the Western Nain province in north central Labrador; and the Grenville province lying south of a line extending approximately from Kaipokok Bay, on the east, around the south end of Michikaman Lake and through a point just north of Wabush Lake.

Economically, the Churchill and Grenville structural provinces are the most important in Labrador thus far. The Churchill province contains the iron-rich Labrador Trough which extends from Ungava Bay into northwest Labrador and south to merge with the metamorphosed Grenville province. This region of Labrador, the Churchill and Grenville provinces, is the leading mineral-producing region in the Atlantic Provinces in terms of value of production.

That part of the Atlantic Provinces which lies in the Appalachian region is characterized by a preponderance of Palaeozoic rocks. Some Precambrian rocks do occur, however, in small areas of New Brunswick and Nova Scotia. On the Island of Newfoundland, Precambrian rocks make up the Long Range Mountains along the northwest; and relatively unaltered Precambrian volcanic and sedimentary rocks occur in the southeast part of the Island. The Precambrian rocks in the Appalachian segment of the Atlantic Provinces are relatively unimportant economically. A pyrophyllite deposit, near Manuels on Newfoundland's Avalon

Peninsula, is being mined from Precambrian rocks, and Precambrian limestone is quarried near Saint John, New Brunswick, as well as on Cape Breton Island, Nova Scotia.

The Atlantic Provinces' Appalachian region underwent extensive deformation twice during Palaeozoic time. The first, the Taconic orogeny, took place at the close of the Ordovician, and the second, the Acadian orogeny, in Devonian time; both of these disturbances developed structures that in the main trend northeasterly. Large granitic intrusions were emplaced in Devonian time producing widespread mineralization.

The Appalachian revolution at the close of the Palaeozoic, which folded and faulted the strata to the south, producing the Appalachian Mountains, had only local effects in the northern Appalachian region. These effects are most strongly shown in eastern Nova Scotia and the Island of Newfoundland.

In New Brunswick and the Island of Newfoundland, rocks of Ordovician age are of prime economic importance. Ordovician rocks, principally volcanics, are the hosts for the massive, pyritic-base metals deposits of the Bathurst-Newcastle district in New Brunswick and the Notre Dame Bay region of Newfoundland. Ordovician ultrabasic intrusive rocks are the hosts for asbestos occurring near Baie Verte, Newfoundland.

In Nova Scotia, Pennsylvanian and Mississippian strata have proven to be of greatest economic importance. All of the province's coal production comes from Pennsylvanian coal measures, and practically all of the province's industrial minerals occur in rocks of Mississippian age.

Thick Palaeozoic sedimentary sequences lie offshore from the Atlantic Provinces. Examination of these sequences by major oil interests has encouraged an extensive search for oil and gas in offshore areas. Although drilling has not produced any economic amount of petroleum or natural gas, results have been encouraging.

Mineral Resource Development and Exploitation

The Atlantic Provinces have a long history of mineral resource development and exploitation. The earliest geological investigations in Canada were conducted in this region, and the first successful and regular mining in Canada also commenced here.

Newfoundland and Labrador

John Cabot, in the employ of King Henry VII, first sailed along the rugged coast of Newfoundland in 1497. Sir Humphrey Gilbert landed at St. John's in 1583 and formally

claimed "New Found Land" in the name of England. John Guy established the first permanent settlement in 1610 at Cupids, on Conception Bay, several miles to the west of St. John's. Despite Newfoundland's centuries-old beginnings, early records of mineral discoveries and development are obscure. Doubtless the quarrying or gathering of suitable stone for building purposes was the first rudimentary mining activity to take place.

The earliest record of mining in Newfoundland dates back to about 1779 when a vein was mined for copper at Shoal Bay south of St. John's. This venture was not successful. The first successful mining enterprise was at La Manche, Placentia Bay, where lead was mined between 1857 and 1873.

During the second half of the 19th century, several copper mines were successfully developed in the Notre Dame Bay region and the Island became a significant copper producer. Newfoundland ranked 14th among the copper-producing countries of the world during the decade 1871-1880.

Development of the Wabana iron ores commenced in 1893 and the first cargo of ore was shipped to Nova Scotia in 1895. When the steel industry was established at Sydney, N.S., in 1900, Wabana became the principal source of iron ore for this enterprise. Production was continuous from Wabana for over 70 years and came to an end in mid-1966.

The mining of copper ores declined and eventually ceased early in the 20th century, and for a time, Wabana accounted for the only mineral production of significance. The exploitation of the large, high-grade, base metals deposits at Buchans, in 1928, was the first major advancement in Newfoundland mining in the present century. Subsequently, mineral exploration and development practically ceased during the economic depression of the early 1930's. The only significant mineral development of this period was the beginning of fluorspar production from the St. Lawrence area in 1933.

Since Confederation in 1949, the value of mineral production in Newfoundland and Labrador has risen from \$27.5 million to \$266.0 million (1967). The most significant event, contributing largely to this expansion, took place in 1954 when the Iron Ore Company of Canada brought into production the large iron ore deposits that straddle the Québec-Labrador boundary.

In 1957, the Tilt Cove copper deposits, dormant for about 40 years, were again brought into production. New mining operations have doubled the value of the mineral production of the province in the last five years. Three more copper mines, the Little Bay, Rambler and Whalesback, began production in 1961, 1964 and 1965 respectively. The Baie Verte asbestos mine began operations in 1963. Due to the exhaustion of copper ore, operations ceased at Tilt Cove in 1967. However, the loss of this producer was offset by the commencement of production from the Gull Pond copper mine of Gullbridge Mines Limited.

In Labrador, the beginning of mining in 1962 and 1965 of the concentrating-grade iron ores of the Wabush Lake area, by two companies, stands as the most recent important development. Labrador has developed into one of the foremost iron ore mining centres in the world.

Exploration for oil and gas began in 1964 off the coast on the Grand Banks. A successful search could lead to developments of great significance to the province.

New Brunswick

The earliest mining in New Brunswick occurred in 1639, when a vessel sailed up the Saint John River to Grand Lake and returned to the New England colony of Massachusetts with a cargo of coal. Limestone was quarried in the southern part of the province as early as 1701 for use in the rebuilding of Port Royal. Champlain had noted and described the abundance of limestone around Saint John nearly a century before.

The first regular mining commenced in 1825 with the mining of coal on a steady basis in the Minto area. Gypsum mining had its start in 1854 and it has been mined continuously near Hillsborough, Albert County, since that time.

Pig iron was produced intermittently at Woodstock, using low grade hematite ores from Jacksontown, around 1848 to 1870. Also in the 19th century, other mineral deposits in the province yielded some production of copper, manganese, antimony, graphite, albertite and salt.

New Brunswick's first Provincial Geologist, Dr. Abraham Gesner, was appointed in 1838; he was the first geologist to be appointed to such a post in a British province. In 1872, the government of the day purchased a diamond drill (one of the first in Canada) to assist parties interested in prospecting. Diamond drilling assistance was continued until it was abandoned in the 1950's.

The most significant event following the development of coal and gypsum mining in the province was the discovery of natural gas and petroleum at Stoney Creek near Moncton in 1909. With the subsequent development of the Stoney Creek field, New Brunswick's mineral industry maintained an annual production pattern for almost 50 years wherein the stable sectors of the industry were gypsum, coal, natural gas and crude petroleum. Other mining ventures were shortlived. Iron ore was produced near Bathurst for a short time, 1910-13. Small amounts of antimony, tungsten, manganese and copper were produced at various localities during the First World War.

In 1942, a peat moss industry was established near Shippegan in Gloucester County. This industry has grown in the last two-and-a-half decades and at present there are eight producers in the province.

In 1950 the construction of the province's first cement plant was commenced near Havelock, Kings County. Production of cement, using local limestone and gypsum commenced in 1952.

Late in 1952, a major base metals deposit was discovered near the old Drummond iron mine southwest of Bathurst. This discovery sparked a staking rush the magnitude of which was without precedent in the history of New Brunswick. Subsequent exploration and development has led to the discovery of over 20 base metals deposits in the Bathurst-Newcastle district. The commencement of base metal production from these newly discovered deposits was initially slow. Heath Steele Mines Limited commenced production in 1957 at its mine located 35 miles northwest of Newcastle. Production was suspended in 1958 but was resumed again in 1962. The Wedge mine of Cominco Ltd. commenced production in 1962 and continued to mid-1968 when operations ceased due to exhaustion of ore. The No. 12 orebody of Brunswick Mining and Smelting Corporation Limited came into production in 1964. Brunswick's No. 6 orebody, the original Bathurst discovery, came into production in 1966. Construction of a smelter at Belledune Point was commenced in 1963. Late in 1966, the Belledune smelter began tune-up operations and became Canada's second producer of primary lead and the fourth producer of primary zinc. The latest base metals mine to be brought into production in this area is the Nigadoo River Mines Limited which commenced production late in 1967.

Nova Scotia

Small quantities of coal, gypsum and stone were mined by the earliest settlers of Nova Scotia. The first regular mining took place in 1720 when coal was mined on the north side of Cow Bay to supply fuel for the French work force engaged in building Fort Louisburg. With the end of the French regime in 1763, coal mining was continued to supply the British troops at Halifax and markets in the New England colonies to the south.

In 1826, the Duke of York, and subsequently the General Mining Association, was granted a 60-year lease of all Nova Scotia mines and minerals not previously granted. The General Mining Association engaged principally in developing the coal industry and established extensive-scale coal mining in Nova Scotia for the first time. Although the General Mining Association's monopoly was broken after about 30 years, it continued to operate coal mines until 1900 when its assets were acquired by Nova Scotia Steel Company, Limited, a predecessor of Dominion Steel and Coal Corporation, Limited (Dosco).

During the 19th century, as the coal industry was developing, the mining of iron ore was moderately successful in Nova Scotia. Iron ore deposits in Annapolis County were mined as early as 1829 and at Londonderry, Colchester County, in 1849.

Many attempts were made to use local iron ore in establishing an early steel industry. The quality of the ore was poor, and mining ceased early in the 20th century.

Gold was first discovered at Mooseland in 1858 and at Tangier in 1860. The first gold mine was brought into production in 1861 and by the 1880's, there were upwards of 60 small mines in production. The annual value of gold production ranked second after coal at the turn of the century. However, production by today's standards was small. Lode gold mining went into steady decline in the 20th century, rallied in the depression years before World War II, and stopped in 1950. In terms of official production, Nova Scotia's gold industry produced a total of about 1,143,000 ounces of gold from 1862 to 1950, only one third of Canada's current annual production even at today's declining rates of output.

Nova Scotia's gypsum industry, which had its beginnings in the 18th century, developed extensively in the 19th century. In 1807 about 100 vessels were engaged in shipping gypsum to the United States. At the time of Confederation in 1867, gypsum was being shipped to the United States through 25 Nova Scotia ports. Gypsum production has continued to the present. Gypsum and coal have been the long-standing mineral commodities of the Nova Scotia mineral industry from its beginnings.

Other mineral developments of lesser importance during the last century included the mining of barite at Five Islands as early as 1874; manganese at Tennycape in 1876; and stibnite at West Gore in 1884.

The Nova Scotia steel industry, so intimately connected with the coal industry, had its beginning when Hope Iron Works, a small forge located in the upper corner of the Graham's shipyard, began business in New Glasgow in 1872. Through many mergers and reorganizations this eventually developed into the Sydney steel complex of Dominion Steel and Coal Corporation, Limited.

Among the highlights of Nova Scotia's mineral industry during the present century was the establishment of a salt industry in 1918 at Malagash. In 1946 brining operations were begun on a salt deposit at Nappan. Ten years later, a salt deposit at Pugwash was developed. In 1940, one of the largest known barite deposits in the world was discovered at Walton and brought into production in 1941. In terms of tonnage, this mine produces 90 per cent of Canada's total barite production. Zinc production commenced at Stirling in the late 1930's, and with interruptions, continued until 1945. In 1957, sulphide mineralization was discovered associated with the barite deposit at Walton; production of lead-copper-silver and zinc-silver concentrates commenced in 1961 but has remained small.

By far the most important recent events of critical importance to Nova Scotia's future mineral economy are related to coal and steel. In 1967, the Cape Breton Development Corporation was created to acquire the coal interests of the Dominion Steel and Coal Corporation, Limited, anticipating a 15-year phase-out of operations. In October 1967, Hawker Siddeley Canada Ltd. (holding controlling interest in Dominion Steel and Coal Corporation, Limited) announced that it would close Dosco's steel plant at Sydney by April 1968. By agreement the operation of the Sydney steel works was subsequently taken over by the Nova Scotia government.

Prince Edward Island

The record of mining development in Prince Edward Island is practically negligible. The earliest settlers used local sand, gravel and stone for building and road construction. These structural materials are still produced on the Island but the quantity is very small in comparison with other provinces.

The entire Island is covered by petroleum exploration leases held by several companies. The adjacent offshore areas are also under lease. The discovery of petroleum or natural gas would establish a mineral industry where there is virtually none at present.

Current Mineral Producers

At the present time, there are over 50 principal mineral producers in the Atlantic Provinces. Their geographic distribution is widespread (Figure 1-1) and in many instances they represent the main economic base of the area in which they are located.

The following sub-sections briefly describe the principal mineral producers in each province, excluding Prince Edward Island where only sand, gravel and crushed stone are produced. Annual capacities, reserves and the quality of those reserves, where known, are mentioned.

Newfoundland and Labrador

1) American Smelting and Refining Company

The Buchans Mine produces zinc, lead, copper, silver, gold and cadmium. The mill operates at about 1,300 tons a day. Reserves were 3.8 million tons at the end of 1966 grading 1.09 per cent copper, 13.04 per cent zinc, 7.36 per cent lead, 4.07 oz. silver and 0.03 oz. gold per ton. This is sufficient to see continued production at the present rate for about 10 years.

2) Atlantic Coast Copper Corporation Limited

Production started in 1961 at this 1,000-ton-a-day copper mine in the Notre Dame Bay area. Ore reserves were estimated in 1961 to be capable of sustaining production for about seven years.

3) British Newfoundland Exploration Limited

The Whalesback copper mine came on stream in late 1965, having an average daily throughput of 1,900 tons a day. Reserves at Whalesback in early 1966 were about 4 million tons grading 1.5 per cent copper. Additional reserves in the nearby Little Deer Pond zone are estimated at about 1 million tons grading 1.74 per cent copper. At present operating levels, production can be anticipated for a further six years.

4) Consolidated Rambler Mines Limited

Mining operations began in mid-1964 on the company's copper-zinc orebody in the Baie Verte area. Reserves in early 1967 stood at almost 200,000 tons of 1.2 per cent copper, 2.5 per cent zinc, 0.17 oz. gold and 0.94 oz. silver in the Main zone and an estimated 2 million tons of 1.65 per cent copper in the East zone. Working at capacity levels would give the mine a minimum life of about four more years.

5) First Maritime Mining Corporation Limited

The wholly-owned Gullbridge Mines Limited began copper mining operations at Gull Pond in early 1967. Daily capacity is 2,000 tons. Ore reserves are in the order of 3.5 million tons grading 1.47 per cent copper, sufficient to maintain production until at least 1972.

6) Iron Ore Company of Canada

Production began in 1954 from open-pit direct-shipping ore deposits at Schefferville. Reserves at the start of operations stood at about 375 million long tons of direct-shipping ore, and aggregate production through 1967 was 117 million long tons.[1/] In 1962, the company's Carol Project came on stream with an annual capacity of 7 million long tons of concentrates. This operation has since been expanded to 10 million tons of concentrates per annum. By the end of 1967, some 8.9 million tons of concentrates and 24 million tons of pellets had been produced. Reserves of Carol Lake are in excess of 1 billion tons of concentrating ore. In future the vast majority of shipments from Carol Lake will be in the form of pellets. Current production in all forms from the Iron Ore Company of Canada is running at an annual rate of some 17 million tons.

1/ Of this, approximately 50 million tons was produced in Labrador, the balance in Québec.

7) Wabush Mines

Full mill capacity operations of 45,000 tons a day were reached at the end of 1965. Concentrates are railed to Pointe Noire, Québec for pelletization. Annual production currently runs at about 6 million tons of pellets. Reserves are estimated to be in the order of 1.8 billion tons of ore averaging 36.5 per cent iron. Production capacity may be substantially increased in the future.

8) Advocate Mines Limited

The company operates an asbestos mine at Baie Verte. Production began in mid-1963. The mill treated just over 2 million tons of ore in 1966 to produce some 65,000 tons of fibre. Ore reserves at the end of 1966 were 55 million tons but were increased by a further 10 million tons in 1967. Production may be increased if market conditions remain favourable.

9) The Flintkote Company of Canada Limited

A gypsum quarry is operated at Flat Bay. Production currently stands at 400,000 to 500,000 tons a year. Proven reserves are 45 million tons of gypsum of better than 90-per-cent purity.

10) Newfoundland Fluorspar Limited

Fluorspar has been produced from the company's mine at St. Lawrence since 1942. This is Canada's only major source of fluorspar at the present time, and production is about 100,000 tons annually. The mine has reserves sufficient to support production at present levels until 1976, and other reserves in the area will assure continued production beyond that time.

11) Newfoundland Minerals Limited

The company has produced pyrophyllite since 1956 from their quarry at Long Pond. Production currently stands at about 30,000 tons a year, and reserves are sufficient for the foreseeable future.

12) North Star Cement Limited

Productive capacity from the plant at Corner Brook is 158,000 tons a year. Reserves of limestone and shale are adequate to support production for many years.

13) Sundew Peat Moss

Extractive operations from the Cochran Pond peat bog on the Avalon Peninsula began in 1964. Production from this property is not steady, but reserves are adequate for many years of continued exploitation.

New Brunswick

1) Brunswick Mining and Smelting Corporation Limited

The company operates two mines in the Bathurst area. The No. 12 mine came on stream in mid-1964 and now operates at full capacity of 4,500 tons a day. Reserves at the start of 1967 were 54.8 million tons grading 3.34 per cent lead, 8.87 per cent zinc, 0.27 per cent copper and 2.16 ounces of silver a ton. A further 12 million tons of 1.20 per cent copper are available in an adjacent zone. The newer No. 6 mine started production late in 1966 and currently runs at capacity of 2,250 tons a day. Reserves at the beginning of 1967 were 13.4 million tons of ore grading 2.37 per cent lead, 5.94 per cent zinc, 0.43 per cent copper and 1.99 ounces of silver a ton. A further 11 million tons of slightly lower grade ore are available at depth. It can be seen that many years of production lie ahead.

2) Heath Steele Mines Limited

A 1,500-ton-a-day mill was built in 1956, but the property never reached continuous production until 1962 at which time half the mill feed came from the Heath Steele property and half on a custom basis from Cominco's Wedge mine. Now, closing of the Wedge mine has prompted full utilization of the mill from Heath Steele. Reserves at the start of 1967 approximated 8.15 million tons grading 2.66 per cent lead, 7.42 per cent zinc, 0.78 per cent copper and 2.58 ounces of silver a ton, plus additional reserves of 3.9 million tons grading 1.77 per cent combined lead and zinc, 2.08 per cent copper and 1.17 ounces of silver a ton. At present full capacity this represents sufficient ore for 20 more years of operation.

3) Nigadoo River Mines Limited

This operation came on stream late in 1967 at a rated capacity of 1,000 tons a day. Reserves are estimated at 1.39 million tons grading 2.97 per cent lead, 2.77 per cent zinc, 0.34 per cent copper and 4.36 ounces of silver a ton. This should be sufficient to support operations until 1971 at least.

4) Peat Moss Producers in New Brunswick

There are currently eight producing peat moss companies in the province with aggregate output in excess of 65,000 tons annually. Most production is exported to the United States. Reserves in the twenty or so bogs which are of commercial importance are well in excess of 35,000,000 tons. A very considerable expansion of the industry could be justified if the demand arose.

5) Canada Cement Company, Limited

Production at a rate of 800,000 barrels annually began at the Havelock plant in 1952. This has been expanded in two stages to the present 2 million barrels annual capacity. Recent production exceeds 225,000 tons of cement a year. Limestone for the plant is quarried on company property and reserves are sufficient to sustain production for many years.

6) Havelock Lime Works Ltd.

Total annual output of limestone from the Havelock quarry is about 40,000 tons, two thirds of which is sold as agricultural limestone. Production has been continuous since shortly after World War II. The company also operates a small gypsum quarry on a contract basis for Canada Cement Company, Limited.

7) Snowflake Lime, Limited

The company operates two limestone quarries at Saint John and a small lime plant at Pokiok. Both quarries have a long history of production and reserves are sufficient for many more years at the present rate of about 30,000 tons a year.

8) Brookville Manufacturing Co. Ltd.

The limestone and dolomite quarry at Brookville began production in 1920 and has been in continuous operation since that time. Production amounts to about 100,000 tons a year, most of which is used for agricultural purposes.

9) New Brunswick Oilfields, Limited

The Stoney Creek field was discovered in 1909 and is primarily a gas field despite repeated attempts to discover larger oil reserves. Although some pools may be present, there are insufficient favourable geological horizons that would enable an oil industry of any magnitude to be established. A very small production of oil and gas will continue for a number of years.

10) The Minto Coalfield

In 1967, production from the Minto coalfield was just over 850,000 tons, and this came from five operations. The main companies are Avon Coal Company, Limited, D.W. & R.A. Mills Limited, C.H. Nichols Co. Ltd., V.C. McMann Ltd. and Midland Mining Co. Ltd. Most mining in the Minto coalfield is by strip methods.

Nova Scotia

1) Dresser Industries Inc. - Dresser Minerals Division

Production of barite from the Walton property began in 1941 and has been continuous since that time, currently being in the order of 180,000 tons annually. Reserves are adequate for about six more years of production at current levels. About 90 per cent of Canadian barite is produced from this mine. A lead-zinc orebody, occurring in the footwall of the barite deposit, has been exploited for a number of years at a rate of 100 tons a day. A fire destroyed the mill and temporarily terminated operations in 1967. Remaining lead and zinc reserves are very small.

2) Fundy Gypsum Company Limited

The company operates two gypsum quarries at Wentworth and Miller Creek, the large-scale development of which began in 1956. Combined annual production is now running at an average of just under 2 million tons. The company also operates an anhydrite quarry at Wentworth which produces about 200,000 tons annually. For the Fundy Gypsum Company, and all other major producers of gypsum and anhydrite in Nova Scotia, reserves are very considerable and will be able to sustain production in the foreseeable future.

3) National Gypsum (Canada) Ltd.

The company has two gypsum quarries in operation at the present time. The East Milford quarry first produced in 1955 and present production is at a rate of nearly 2 million tons a year. Production from the Walton deposit has declined from a peak of about 250,000 tons in 1955 to only about 20,000 tons at present. The quarry is operated on a contract basis by B.A. Parsons who also quarries anhydrite under contract, production of which is about 35,000 tons annually.

4) Domtar Construction Materials Ltd.

The small gypsum quarry at McKay Settlement has been in operation since 1944. Present production is under contract to D. MacDonald and runs at about 13,000 tons annually.

5) Little Narrows Gypsum Company Limited

Present annual production of about 350,000 tons of gypsum is from the Dorr and Western quarries. The quarries only operate for six months every year during the summer. In 1962 the company opened an anhydrite quarry at Little Narrows which currently produces in the order of 50,000 tons a year.

6) Georgia-Pacific Corporation - Bestwall Gypsum Division

The gypsum quarry at River Denys was developed in 1962 and average production to date has been in the order of 640,000 tons a year.

7) The Canadian Rock Salt Company Limited

The underground rock salt mine at Pugwash came on stream in late 1959. When operating at capacity, output is 1,200 tons a day, but seasonal variations in demand for the salt mean that only about 350,000 tons are produced annually. Reserves are adequate to meet all production needs in the foreseeable future.

8) Domtar Chemical Limited - Sifto Salt Division

Production from this brining operation began in 1947 and has steadily risen to the present annual production level of about 110,000 tons of salt. Reserves are sufficient to assure production for many years.

9) Annapolis Valley Peat Moss Company Limited

Although production of peat moss has averaged only about 3,000 tons a year from the Caribou bog, reserves stand at over half a million tons. It is likely that some growth in production will be seen in the future.

10) Maritime Cement Company Limited

Annual cement capacity of the plant at Brookfield, which came on stream in 1965, is 1.4 million barrels. This plant is supplied with limestone from the company's own quarry at a rate of some 300,000 tons a year. There is no shortage of reserves.

11) Mosher Limestone Company Limited

The limestone quarry at Upper Musquodoboit produces about 13,000 tons of dolomite and 70,000 tons of limestone

annually. Reserves are considerable. Scotia Limestone Limited is a wholly-owned subsidiary with two quarries on Cape Breton Island. The Irish Cove limestone quarry produces about 140,000 tons a year and the Frenchvale dolomite quarry about 100,000 tons annually. Reserves are sufficient to support production at present levels for many years.

12) Cape Breton Development Corporation

This Crown corporation operates five collieries on Cape Breton Island which produce some 90 per cent of Nova Scotia's coal output. Production is running at about 3.4 million tons annually. There is no shortage of reserves, but the demand for coal from Nova Scotia has fallen and the industry will gradually decline.

13) River Hebert Coal Company Limited

The company operates a coal mine in the Joggins coalfield and present production runs at about 60,000 tons a year.

14) Springhill Coal Mines Limited

Two coal mines, with a combined annual production of about 80,000 tons, are operated in the Springhill coalfield by this company.

15) Drummond Coal Company Limited

Production from the Drummond mine in the Pictou coalfield is about 50,000 tons annually.

16) Evans Coal Mines Limited

This company's mine, in the Inverness coalfield, currently produces some 40,000 tons a year.

17) Bras d'Or Coal Company, Limited

Production from the company's mine in the Sydney coalfield is about 110,000 tons a year.

18) Thorburn Mining Limited

This is the company which was formed to continue mining operations at the McBean mine after it had been closed by the Dominion Steel and Coal Corporation. The mine, which is operated by the Cape Breton Development Corporation on behalf

of the Pictou County Research and Development Commission, will continue in operation on a reduced scale for three or more years to allow a gradual adjustment in Pictou County as coal mining operations decrease.

TABLE 1-1

Principal Mineral Producers of the Atlantic Provinces

Newfoundland and Labrador

Reference Number*	Company	Products
1	Iron Ore Company of Canada	Iron ore
2	Iron Ore Company of Canada	Iron ore
3	Wabush Mines	Iron ore
4	Advocate Mines Ltd.	Asbestos
5	Consolidated Rambler Mines Ltd.	Copper, Gold, Zinc
6	Atlantic Coast Copper Corp. Ltd.	Copper
6	British Newfoundland Exploration Ltd.	Copper
7	Gullbridge Mines Ltd.	Copper
8	American Smelting and Refining Company (Buchans Unit)	Copper, Silver, Gold
9	North Star Cement Ltd.	Limestone and Shale
10	Flintkote Company of Canada	Gypsum
11	Newfoundland Fluorspar Ltd.	Fluorspar
12	Newfoundland Minerals Ltd.	Pyrophyllite
12	Sundew Peat Moss	Peat Moss

New Brunswick

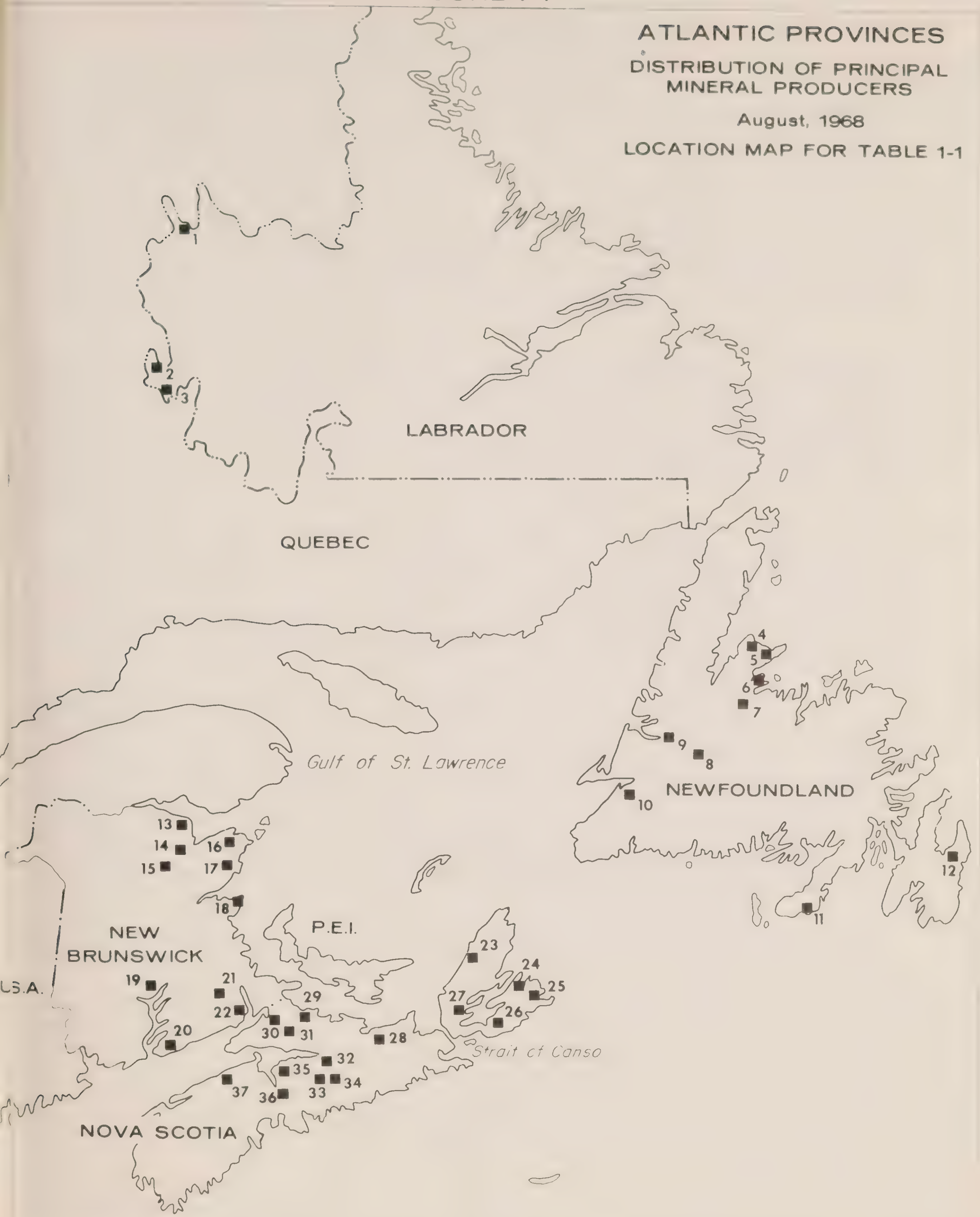
Reference Number*	Company	Products
13	Nigadoo River Mines Ltd.	Lead, Zinc, Copper, Silver
14	Brunswick Mining and Smelting Corp. Ltd.	Zinc, Lead, Copper, Silver
15	Heath Steele Mines Ltd.	Zinc, Lead, Copper, Silver
16	Grande Anse Peat Moss Co. Ltd.	Peat Moss
16	Atkins & Durbrow (N.B.) Ltd.	Peat Moss
16	Acadian Peat Moss Co. Ltd.	Peat Moss
16	Atlantic Peat Moss Ltd.	Peat Moss
16	Fafard Peat Moss Co. Ltd.	Peat Moss
16	Western Peat Moss Ltd.	Peat Moss
17	Heveco Ltd.	Peat Moss
18	Theriault and Hachey Peat Moss Ltd.	Peat Moss
19	Avon Coal Co. Ltd.	Coal
19	D.W. & R.A. Mills Ltd.	Coal
19	C.H. Nichols, Ltd.	Coal
19	V.C. McMann, Ltd.	Coal
19	Midland Mining Co. Ltd.	Coal
20	Snowflake Lime, Limited	Limestone and lime
20	Brookville Manufacturing Co. Ltd.	Crushed & Ground Limestone
21	Canada Cement Co. Ltd.	Limestone, Shale, Gypsum
21	Havelock Lime Works Ltd.	Crushed & Ground Limestone
22	New Brunswick Oilfields, Ltd.	Natural Gas, Crude Oil
22	Canadian Gypsum Co. Ltd.	Gypsum

Nova Scotia

Reference Number*	Company	Products
23	Evans Coal Mines Ltd.	Coal
24	Cape Breton Development Corp.	Coal
25	Bras d'Or Coal Co. Ltd.	Coal
26	Scotia Limestone Ltd.	Crushed limestone
27	Georgia Pacific Corp., Bestwall Gypsum Division	Gypsum
27	Little Narrows Gypsum Co. Ltd.	Gypsum, Anhydrite
28	Thorburn Mining Ltd.	Coal
28	Drummond Coal Co. Ltd.	Coal
29	Canadian Rock Salt Co. Ltd.	Salt
30	Domtar Chemicals Ltd.	Salt
31	River Hebert Coal Co. Ltd.	Coal
31	Springhill Coal Mines Ltd.	Coal
32	Canada Cement Company, Ltd.	Limestone
33	National Gypsum (Canada) Ltd.	Gypsum
34	Mosher Limestone Co. Ltd.	Dolomite, Limestone
35	Dresser Minerals Division	Barite, (Lead, Zinc, Copper, Silver)
35	National Gypsum (Canada) Ltd.	Gypsum, Anhydrite
36	Domtar Construction Materials Ltd.	Gypsum
36	Fundy Gypsum Co. Ltd.	Gypsum, Anhydrite
37	Annapolis Valley Peat Moss Co. Ltd.	Peat Moss

* The numbers in Column 1 correspond to the numbered locations on the sketch map in Figure 1-1.

FIGURE 1-1


ATLANTIC PROVINCES
DISTRIBUTION OF PRINCIPAL MINERAL PRODUCERS
August, 1968
LOCATION MAP FOR TABLE 1-1
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QUEBEC
Gulf of St. Lawrence
NEWFOUNDLAND
NEW BRUNSWICK
P.E.I.
U.S.A.
NOVA SCOTIA
Strait of Canso
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Unexploited Mineral Occurrences of Some Economic Significance

When an assessment of the mineral potentials of the various Atlantic Provinces is made, it is at once obvious that each province has its own distinctive commodity grouping which offers the greatest opportunities in the future. Thus, Newfoundland - which already depends upon iron ore for better than 75 per cent of its mineral output - will continue to anticipate that the bulk of its output will be iron ore in the foreseeable future. Of the other mineral resources, copper and zinc will probably maintain their second position, and new major developments will principally be confined to the metallic sector.

In Nova Scotia, where about 65 per cent of mineral production is from coal mining, a decline in activity seems inevitable. Base metals thus far offer limited scope for development in the future, but many industrial minerals are available in large quantities and expansion may be seen if markets can be found for the products. Gypsum, salt, limestone and building stone offer the greatest potential.

New Brunswick has only relatively recently become a major mineral producer, with an almost fivefold increase in the value of production in only seven years. In this province the potential undoubtedly lies in the exploitation of base metals deposits. A considerable number of important occurrences are known, but the resource potential has by no means been fully investigated to date.

Table 1-2 lists the unexploited mineral occurrences in the Atlantic Provinces which would appear to offer the best opportunity of being brought to production at some time in the future. Where known, the reserves and grade are listed, but in a number of instances reference is made to a general area in which considerable exploration activity has been seen and which still appears to be of sufficient interest to warrant further investigation. The locations of the occurrences listed in Table 1-2 are shown in Figure 1-2.

It will be noted that in Table 1-2 almost every present-day mineral-producing area is listed. This is not unusual because it is indeed rare to find single economically feasible occurrences, and therefore it is often best to look for major mineral deposits in the vicinity of those already known. This is particularly true regarding base metals in the Atlantic Provinces. For iron ore the resource development situation is different because gigantic deposits are already known in Labrador and their future exploitation will await market development, the scale of new supply being determined solely by market demand.

A number of other metals such as molybdenum, tungsten, niobium, strontium and uranium are known to occur in interesting

quantities and grades. However, market conditions and transportation problems, which are often very costly to overcome, have in many cases made exploitation uneconomic to date. It is probably true to state that a number of the somewhat marginally economic mineral occurrences will not be exploited unless a major occurrence is found in the vicinity. It often requires a major find to bear the costs of installing roads, docks, and power facilities before less important occurrences can be brought to production.

A very considerable number of the occurrences listed in both Table 1-2 and 1-3 have seen limited production in times of national emergency when strategic needs have demanded production regardless of economic considerations. This has been particularly true of metallic occurrences.

In the field of industrial minerals such as gypsum, limestone, salt and materials for the construction industry, the Atlantic Provinces are well endowed with resources, the total quantity of which is unknown. Reserves are so substantial that production can be assured for the foreseeable future. The level of extraction will be entirely dependent upon market conditions.

On the Island of Newfoundland there are considerable reserves of silica the exploitation of which is dependent upon finding markets for the product.1/ Fluorspar is also known in a number of locations. This product is important in aluminum smelting, and present production from Newfoundland is captive to that industry. Peat moss reserves are abundant in a number of locations, but once more, exploitation will be a matter of establishing markets.

Finally, the search for oil and gas reserves both on land and offshore continues. The centre of attention is now focused on offshore activity. A number of small "shows" have been found, but thus far drilling activity has been limited and no occurrences of commercial significance have been located. However, it is reported that the companies involved have encouraging signs and therefore it can be assumed that exploration activity will continue for a considerable length of time. A major exploratory drilling program will commence in the latter part of 1969.

1/ *See* footnote (‡) to Table 1-2.

TABLE 1-2

Unexploited Mineral Occurrences of Some Economic Significance

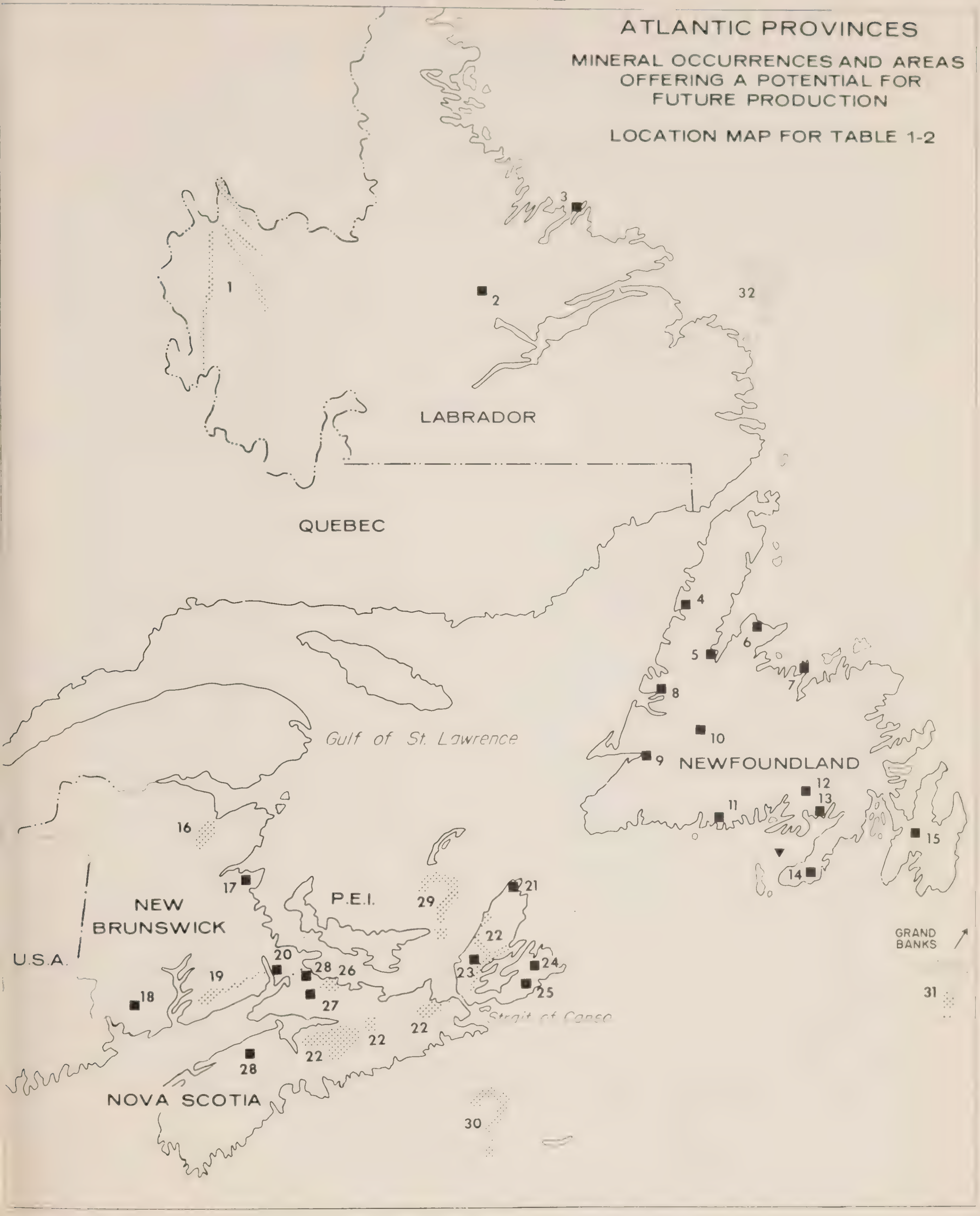
Newfoundland and Labrador

Reference Number*	Location or Name	Minerals Present	Reserves and Grade Where Known
1	Labrador Trough	Iron Ore	Up to 7 billion tons of 36-54% Fe
2	Mann No. 1	Beryllium, Colombite	9,000 tons per vert. ft. of 0.44% BeO and 0.24% Cb_2O_5
3	Aillik	Molybdenum	. .
3	Kitts	Uranium	. .
4	Daniels Harbour	Zinc	585,000 tons of 6.6% Zn
5	White Bay area	Copper	. .
6	Baie Verte area	Asbestos	. .
7	Notre Dame Bay area	Copper	. .
8	West Coast area	Copper	. .
9	St. George's Bay area	Gypsum	About 1 billion tons
10	Buchans area	Copper	. .
10	Tulks Pond	Zinc, Lead, Copper	600,000 tons of 5% Zn, 1.5% Pb, 1.5% Cu
11	Grey River	Wolfram	600,000 tons of 0.6-0.7% WO_3
12	South Coast and Interior	Lead, Zinc, Silver	. .
13	Rencontre East	Molybdenum	70,000 tons of 0.325% Mo
14	Burin Peninsula	Fluorspar	. .
15	Random Formation ‡	Silica	. .
New Brunswick			
16	Newcastle-Bathurst area	Copper, Zinc, Lead	. .
17	Eel River Bog	Peat Moss	Over 35,000,000 tons
18	Mount Pleasant	Bismuth, Tin, Zinc Wolfram	. .
19	Many areas	Gypsum	Almost unlimited
20	Weldon-Gautrea	Salt	1 billion tons
20	Dorchester	Salt	3 billion tons
Nova Scotia			
21	Meat Cove	Zinc	4,400,000 tons of 3.5% Zn
22	Many areas	Gypsum	Almost unlimited
23	Lake Ainslie area	Barite, Fluorspar	3,043,000 tons of 46% $BaSO_4$, 17% CaF_3
24	Mariner	Copper, Molybdenum	100,000 tons of 3.1% Cu
25	Silver Mines	Lead	44,467,300 tons of 2.7% Pb
26	Many locations	Salt	Almost unlimited
27	Enon	Strontium	Up to 1,000,000 tons of 75% $SrSO_4$
28	Many locations	Peat Moss	Over 2,000,000 tons
Atlantic Provinces (Offshore Areas)			
29	Gulf of St. Lawrence	Oil-Gas	Nothing commercial found to date.
30	Nova Scotia Coast	Oil-Gas	Nothing commercial found to date.
31	Grand Banks	Oil-Gas	Nothing commercial found to date.
32	Labrador Coast	Oil-Gas	Nothing commercial found to date.

* The numbers in Column 1 correspond to the numbered locations on the sketch map in Figure 1-2.

‡ Newland Enterprises Limited commenced quarrying in the Random formation near Long Harbour Placentia Bay, in October 1968, to supply silica for the newly constructed $40-million phosphorus-producing plant of Electric Reduction Company of Canada Ltd. The plant will require 200,000 tons of silica a year when in full production.

FIGURE 1-2


ATLANTIC PROVINCES
MINERAL OCCURRENCES AND AREAS OFFERING A POTENTIAL FOR FUTURE PRODUCTION
LOCATION MAP FOR TABLE 1-2
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NEWFOUNDLAND
NEW BRUNSWICK
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TABLE 1-3

Mineral Occurrences of Little or No Economic Significance at Present

Newfoundland and Labrador

Reference Number*	Location‡	Minerals Occurring
1	Seal Lake area	Copper
2	Port au Port Peninsula	Lead, Zinc
3	St. George's Bay area	Iron Ore, Ilmenite
4	Bay of Islands area	Chromium, Asbestos
5	Brownings	Gold
6	White Bay	Rutile
7	Goldenville	Gold
8	Notre Dame Bay	Nickel
9	Moreton's Harbour	Gold, Antimony
10	Chrome Hill	Chromium
11	Gander River	Magnesite
12	Burnt Hill	Chromium
13	Avalon Peninsula	Copper, Gold, Lead, Zinc, Silver
14	Kelligrews area	Manganese
15	Bell Island	Iron Ore

New Brunswick

Reference Number*	Location‡	Minerals Occurring
16	Tetagouche Falls	Manganese
17	Austin Brook	Iron Ore
18	Stonehaven area	Grindstone
19	Burnt Hill area	Molybdenum, Wolfram
20	Woodstock	Iron Ore, Manganese
21	Lake George	Antimony
22	Harvey	Uranium
23	St. Stephen area	Nickel
24	Square Lake	Molybdenum, Bismuth, Wolfram
25	Markhamville area	Manganese
26	Albert Mines	Oil Shale

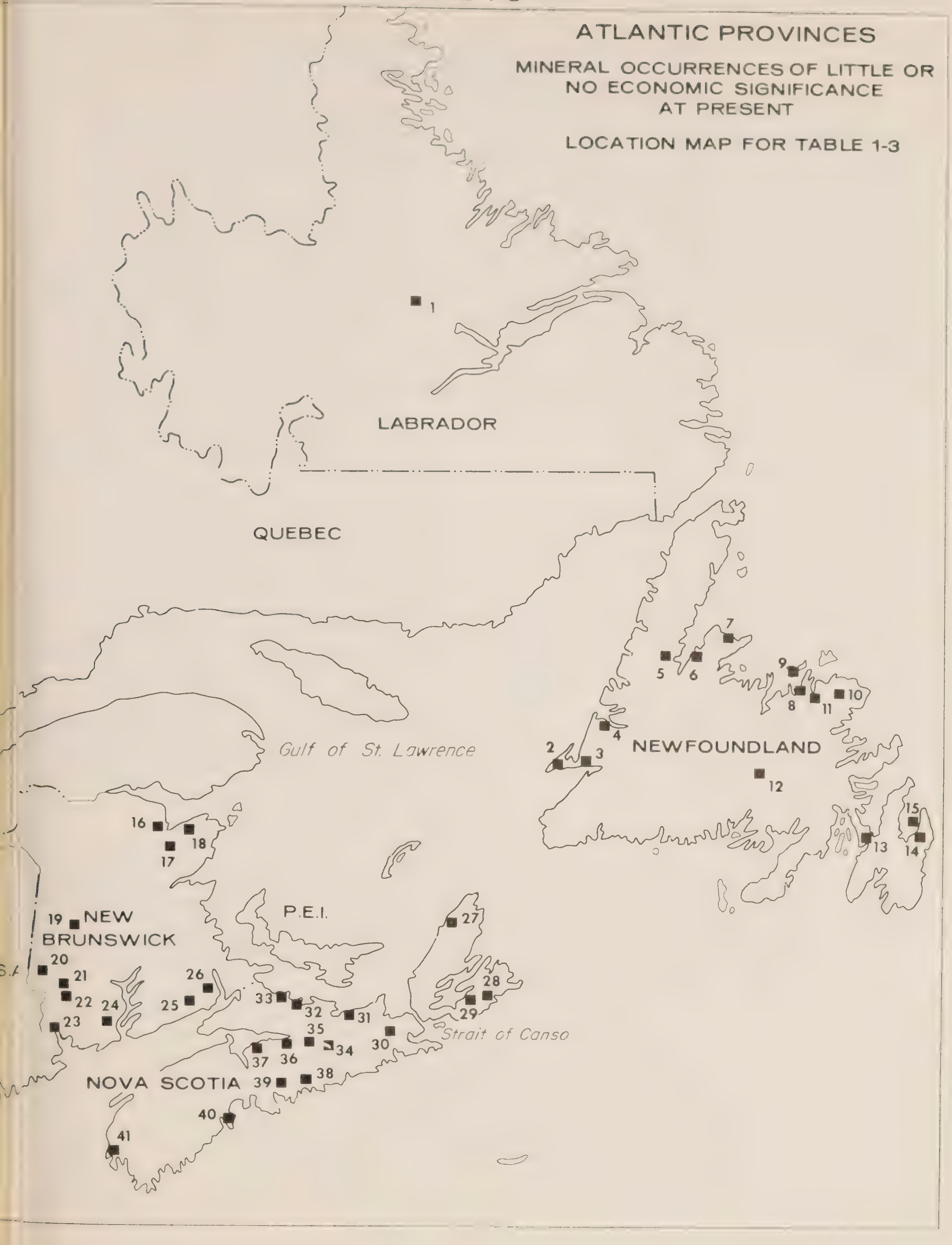
Nova Scotia

Reference Number*	Location‡	Minerals Occurring
27	Daphine Brook	Lead, Zinc, Silver
28	Stirling area	Lead, Zinc, Copper
29	Loch Lomond	Manganese
30	Forest Hill	Alumina
31	Cumberland-Pictou Counties	Grindstone
32	Wentworth district	Copper
33	Malagash	Potash
34	Smithfield-Gays River	Lead, Zinc
35	Brookfield-Hilden	Barite, Sulphur
36	Tenecape	Manganese
37	West Gore	Antimony
38	Lake Charlotte	Wolfram
39	Scheelite Mine	Wolfram
40	Indian Path	Wolfram
41	Chegoggan Point	Garnet
-	Atlantic Beaches	Gold, Tin

* The numbers in Column 1 correspond to the numbered locations on the sketch map in Figure 1-3.

‡ In some instances the location listed covers a number of different occurrences which are in the same general area but which may be geologically unrelated.

FIGURE 1-3


ATLANTIC PROVINCES
MINERAL OCCURRENCES OF LITTLE OR NO ECONOMIC SIGNIFICANCE AT PRESENT
LOCATION MAP FOR TABLE 1-3
LABRADOR
QUEBEC
Gulf of St. Lawrence
NEWFOUNDLAND
NEW BRUNSWICK
P.E.I.
NOVA SCOTIA
Strait of Canso
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Mineral Occurrences of Little or No Economic Significance at Present

Literally thousands of mineral occurrences have been discovered in the Atlantic Provinces over the years. By and large most of these occurrences are either insignificant or of very low economic potential. Table 1-3 lists a selection of mineral occurrences in the Atlantic Provinces which are of passing interest but at present have little or no economic significance. It will be noted that the great majority of occurrences listed concern metallic products. This is because most of the nonmetallic and industrial mineral resources cover large areas and are already well known. The locations of the occurrences listed in Table 1-3 are shown in Figure 1-3.

Although most of the occurrences listed in Table 1-3 are quite small, they serve to give an indication of minerals to be found in different localities and therefore may act as a guide for further exploration activity in the future. It should be noted, at the same time, that many of the minerals listed are already in relatively abundant supply from other sources and therefore it is most unlikely that their production could ever compete economically with sources where reserves are not only higher but of better grades. Of course this does not completely eliminate the possibility of finding larger and higher-grade deposits of minerals such as chromium, manganese, ilmenite, rutile, antimony and tin. There is no chance of the gold properties being brought to production at the present time, but a higher gold price would undoubtedly give great stimulation to exploration activity and production might become a reality. The occurrences of copper, molybdenum, lead, zinc and silver are also of interest, but activity will be mainly centred in the areas indicated in Table 1-2 where the potential is greatest. Once more, a major find in any area would mean a complete reappraisal of all mineral occurrences in that area.

In the industrial minerals field, production cannot be anticipated at this time from any of the occurrences listed because of the presence of economically more attractive alternatives. However, they should not be entirely overlooked, for they can be elevated to a position of some importance in times such as those of national emergency.

2. MINERAL PRODUCTION

Regional Aspect

The value of mineral production in the Atlantic Provinces in 1967 was $436.4 million compared with $98 million in 1950 and $11 million in 1900. Of the total 1967 production, the metallics contributed about 72 per cent and the industrial minerals and mineral fuels, about 14 per cent each. In the industrial minerals sector, structural materials accounted for 53 per cent of the sector's output value; nonmetallics, 47 per cent. In 1967 the Atlantic Provinces contributed almost 10 per cent to the total Canadian mineral production value of $4.39 billion. The Atlantic Provinces produce a wide array of mineral commodities, as shown in Table 2-1.

Iron Ore

In terms of value of production, iron ore outranks by far all other minerals produced in the four provinces, accounting for 48 per cent in 1967. The entire production of iron ore comes from Labrador from mines operated by two companies, Iron Ore Company of Canada and Wabush Mines. In addition to accounting for almost half the total value of mineral production in the Atlantic Provinces in 1967, Labrador iron ore accounted for 45 per cent of the total value of all iron ore produced in Canada. Labrador is one of the foremost iron ore mining centres in the world.

Base Metals

Base metals production (copper, lead and zinc) including byproduct gold, silver and cadmium, ranks next to iron ore in terms of value in the Atlantic Provinces. In 1967 these metals accounted for almost one quarter of the total value of all mineral production from the four provinces. New Brunswick is the leading base metals producer in the region, accounting for almost two thirds of the region's output of these metals. Production of base metals in New Brunswick is centred in the now famous Bathurst-Newcastle district where several mines are operated by Brunswick Mining and Smelting Corporation Limited, Heath Steele Mines Limited and Nigadoo River Mines Limited. Development work continues on other base metal deposits in this district and new mines will undoubtedly be brought into production in the years ahead.

TABLE 2-1

Atlantic Provinces Mineral Production and Percentage Distribution by Sectors*, and Commodities 1967

Sector and Commodity	Newfoundland and Labrador			Nova Scotia			New Brunswick			Prince Edward Island			Atlantic Provinces (combined)		
	Production	% of Sector	% of Grand Total	Production	Sector	% of Grand Total	Production	% of Sector	% of Grand Total	Production	% of Sector	Grand Total	Total Production	% of Sector	Grand Total
	$ 000	%	%	$ 000	%	%	$ 000	%	%	$ 000	%	%	$ 000	%	%
Metallics															
Copper	18,733	7.6	7.0	38	12.0	..	5,336	7.9	5.9	-	-	-	24,107	7.6	5.5
Iron Ore	210,025	84.7	79.0	-	-	-	-	-	-	-	-	-	210,025	66.5	48.2
Lead	6,580	2.6	2.5	110	34.8	0.1	12,701	18.8	14.2	-	-	-	19,391	6.1	4.4
Silver	1,832	0.7	0.7	155	49.1	0.2	4,830	7.1	5.4	-	-	-	6,817	2.2	1.6
Zinc	9,882	4.0	3.7	13	4.1	..	44,548	65.9	49.7	-	-	-	54,443	17.2	12.5
Gold	925	0.4	0.3	-	-	-	61	0.1	..	-	-	-	986	0.3	0.2
Cadmium	-	-	-	-	-	-	147	0.2	0.1	-	-	-	208	0.1	..
Total	247,977	100.0	93.2	316	100.0	0.4	67,623	100.0	75.4	-	-	-	315,916	100.0	72.4
Industrial Minerals															
Nonmetallics															
Asbestos	10,234	56.8	3.8	-	-	-	-	-	-	-	-	-	10,234	16.7	2.3
Barite	-	-	-	1,522	5.6	1.9	-	-	-	-	-	-	1,522	2.5	0.4
Fluorspar	2,097	11.7	0.8	-	-	-	-	-	-	-	-	-	2,097	3.4	0.5
Gypsum	937	5.2	0.4	7,100	26.3	9.0	245	1.7	0.3	-	-	-	8,282	13.5	1.9
Peat Moss	-	-	-		unavailable		1,543	10.7	1.7	-	-	-	1,543	2.5	0.4
Salt	-	-	-	4,152	15.4	5.3	-	-	-	-	-	-	4,152	6.8	0.9
Soapstone, Talc and Pyrophyllite	450	2.5	0.2	-	-	-	-	-	-	-	-	-	450	0.7	0.1
Sulphur in Smelter Gas	6	..	..	-	-	-	310	2.1	0.3	-	-	-	316	0.5	..
Quartz	-	-	-	48	0.2	0.1	-	-	-	-	-	-	48	0.1	..
Grindstone	-	-	-	-	-	-	3	..	..	-	-	-	3	..	..
Sub-Total	13,724	76.2	5.2	12,822	47.5	16.2	2,101	14.5	2.3	-	-	-	28,647	46.8	6.5
Structural Materials															
Cement	1,532	8.5	0.6	3,517	13.0	4.5	4,043	28.0	4.5	-	-	-	9,092	14.9	2.1
Clay Products	281	1.6	0.1	1,374	5.1	1.7	569	3.9	0.6	-	-	-	2,224	3.6	0.5
Lime	-	-	-	-	-	-	79	0.5	0.1	-	-	-	79	0.1	..
Sand and Gravel	2,380	13.2	0.9	7,630	28.2	9.7	4,450	30.8	5.0	1,404	82.4	82.4	15,864	25.9	3.6
Stone	95	0.5	..	1,679	6.2	2.1	3,223	22.3	3.6	300	17.6	17.6	5,297	8.7	1.2
Sub-Total	4,288	23.8	1.6	14,200	52.5	18.0	12,364	85.5	13.8	1,704	100.0	100.0	32,556	53.2	7.5
Total	18,012	100.0	6.8	27,022	100.0	34.2	14,465	100.0	16.1	1,704	100.0	100.0	61,203	100.0	14.0
Mineral Fuels															
Coal	-	-	-	51,681	100.0	65.4	7,490	98.6	8.4	-	-	-	59,171	99.8	13.6
Natural Gas	-	-	-	-	-	-	83	1.1	0.1	-	-	-	83	0.1	..
Petroleum	-	-	-	-	-	-	26	0.3	..	-	-	-	26	..	..
Total	-	-	-	51,681	100.0	65.4	7,599	100.0	8.5	-	-	-	59,280	100.0	13.6
GRAND TOTAL	265,989		100.0	79,019		100.0	89,687		100.0	1,704		100.0	436,399		100.0

* The mineral industry is comprised of three sectors - metallics, industrial minerals and mineral fuels. The industrial minerals sector consists of two groups: non-metallics and structural materials.

The Island of Newfoundland is the source of most of the rest of the base metals and byproduct gold and silver production in the Atlantic Provinces, accounting for over one third in 1967. One of the most notable producers is the Buchans mine of American Smelting and Refining Company which has been in continuous production for the past 40 years. Other base metals mines on the Island of Newfoundland currently in production are operated by Atlantic Coast Copper Corporation Limited, British Newfoundland Exploration Limited (Whalesback mine), Consolidated Rambler Mines Limited and Gullbridge Mines Limited.

In Nova Scotia, base metals in 1967 amounted to only 0.3 per cent of the total value of base metals production in the region. Nova Scotia's sole producer is the Walton mine of Dresser Minerals Division of Dresser Industries Inc. Although the Walton mine is primarily a barite mine, a lead-zinc-silver-copper orebody occurs along the footwall of the barite deposit and production is maintained through the same shaft as the barite production.

Coal

Coal production ranks next after base metals, and in 1967 this traditional fuel accounted for almost 14 per cent of the total value of all mineral production in the Atlantic Provinces. Nova Scotia is the largest producer, with the bulk of production coming from the Sydney coalfield on Cape Breton Island. In 1967 coal production represented almost two thirds of the total value of Nova Scotia mineral production. In New Brunswick, the only other coal-producing province in the Atlantic region, coal production was the equivalent of about 8 per cent of the total value of that province's mineral production. Coal production in New Brunswick comes entirely from the Minto coalfield at the northern end of Grand Lake. Prior to 1963, coal was for years the major mineral commodity produced in New Brunswick.

Coal mining in Nova Scotia has undergone a long period of decline in importance since World War II as its major markets have gradually been taken over by more economic sources of energy for heating, transportation, and metallurgical purposes. The continued existence of a coal industry of any significance has been dependent for many years upon large-scale financial assistance, federal and provincial, that has enabled the companies to continue their mining operations.

In 1967 an agreement was consummated between the Governments of Canada and Nova Scotia on a new policy for the Nova Scotia coal industry. The agreement called for the establishment of a Crown corporation to acquire the coal mining and related interests of the Dominion Steel and Coal Corporation, located on Cape Breton Island, for the purposes of rationalizing the coal industry and simultaneously encouraging the development

of other forms of economic endeavour on the Island. The agreement also called for the assumption by Nova Scotia of complete financial responsibility for such support for the independent coal mines in the province as it considers appropriate and necessary. Subsequently, during June 1967, Parliament passed the act establishing the Cape Breton Development Corporation (DEVCO). This corporation acquired the Sydney-Glace Bay area coal mines and related facilities on April 1, 1968. Also, on April 1, 1968, Nova Scotia assumed complete financial responsibility for the province's independent mines. These two actions effectively ended the 40-year-old federal subvention system for Nova Scotia coal mines.

In New Brunswick the coal mining industry has become increasingly uneconomic in the face of rising mining costs and loss of markets. It is estimated that at best the province has coal reserves for about 15 years of production. Commencing in 1968, New Brunswick will receive from the federal government capital grants totalling nearly $20 million over five years. These grants are designed to assist the provincial government in taking over management of coal production in the Minto coalfield in order to bring operations to an orderly conclusion as reserves are exhausted, and to assist in developing alternative employment opportunities in the Minto district. The grants will replace payments under the federal coal subvention system.

Other Mineral Commodities

All other mineral commodities produced in the Atlantic Provinces collectively accounted for 14 per cent of the total value of the region's mineral production in 1967. Production included such minerals and materials as asbestos, barite, fluorspar, gypsum, peat moss, salt, pyrophyllite (talc), sulphur (from smelter gas), quartz, grindstone, cement, clay products, lime, sand and gravel, stone, natural gas and petroleum. Aside from sand and gravel, which accounted for 3.6 per cent of the total value of mineral production from the four provinces, all other minerals in this group were below 3 per cent of the total value, with many below 1 per cent. Some, such as quartz (produced in Nova Scotia) and lime, natural gas and petroleum (produced in New Brunswick) accounted for less than 0.1 per cent of the region's total mineral value, almost negligible amounts in the over-all total.

Despite the relatively small value of some industrial minerals produced in the Atlantic region, they are nonetheless important in terms of total Canadian production of these minerals. In Newfoundland in 1967, Newfoundland Fluorspar Limited, the sole fluorspar producer in the Atlantic region, had a production value of $2.1 million representing 0.5 per cent of the total value of mineral production in the Atlantic region. But this was essentially the total Canadian output of fluorspar. Nova Scotia produced almost three quarters of the total Canadian

production of barite. New Brunswick, Nova Scotia and Newfoundland collectively produced over three quarters of the total Canadian gypsum output. Almost half of the total Canadian production of the soapstone, talc and pyrophyllite group of minerals came from the Avalon Peninsula in Newfoundland.

Employment

Table 2-2 shows the trend in mining industry employment over the period 1961-1967 for each of the Atlantic Provinces. The steady rise in Newfoundland and Labrador was checked in 1967, mainly due to the closure in mid-1966 of the Wabana iron ore mine on Bell Island. The rise in New Brunswick has continued, due principally to developments in the Bathurst-Newcastle base metals district. In Nova Scotia, mining industry employment fell for the second consecutive year in 1967, and it is anticipated that this decline will continue as the number of producing coal mines decreases. The future employment expectations for each province are considered in Chapter 4 of this report.

TABLE 2-2

Mining Industry Employment in the Atlantic Provinces 1961-67

Year	Newfoundland & Labrador	New Brunswick	Nova Scotia	Total
	----------	---------- 000	----------	----------
1961	3.3	1.4	8.1	12.8
1962	3.3	1.5	7.7	12.5
1963	4.2	1.7	8.0	13.9
1964	4.8	2.0	7.5	14.3
1965	5.9	2.3	7.9	16.1
1966	6.1	2.5	7.5	16.1
1967	5.7	2.6	7.3	15.6

Source: Estimates of Employees by Province and Industry. Feb. 1968. D.B.S.

Capital and Repair Expenditures

Table 2-3 shows capital (i.e. new) expenditure and repair expenditure in mining in the Atlantic Provinces from 1950 to 1968. Both capital and repair expenditures in the mining industry of the Atlantic Provinces have experienced fluctuations from year to year, but have demonstrated an upward trend for the past two decades. Generally speaking, the changes have been far

more pronounced in capital expenditures than in repair expenditures, but this is only to be expected. When a mine is brought into production, as many have in the period under consideration, the capital expenditures take place over a relatively short time. At a producing mine, repair expenditures are expected to be small for the first few years but will then increase as machinery gets older and requires more maintenance. At this stage, additional capital expenditure may have to be made in order to replace worn out and outdated equipment, but such capital expenditure will be but a fraction of the initial investment to bring the mine to production.

TABLE 2-3

Capital and Repair Expenditures - Mining
The Atlantic Provinces 1950-68

	New			Repair			Total
	Constr.	Mach. and Equip.	Total	Constr.	Mach. and Equip.	Total	New + Repair
	$ 000						
1950	786	3,598	4,384	689	4,925	5,614	9,998
1951	1,864	8,671	10,535	702	5,832	6,534	17,069
1952	4,781	6,121	10,902	1,916	5,370	7,286	18,188
1953	3,030	6,570	9,600	1,402	6,996	8,398	17,998
1954	4,534	4,646	9,180	1,031	3,947	4,978	14,158
1955	6,716	4,819	11,535	1,140	4,501	5,641	17,176
1956	11,531	12,604	24,135	1,277	6,107	7,384	31,519
1957	7,938	7,223	15,161	1,358	5,852	7,210	22,371
1958	2,033	3,757	5,790	1,314	5,078	6,392	12,182
1959	3,509	5,503	9,012	1,210	4,185	5,395	14,407
1960	15,220	5,999	21,219	1,703	6,695	8,398	29,617
1961	52,843	8,064	60,907	1,365	8,636	10,001	70,908
1962	86,517	51,291	137,808	1,700	7,759	9,459	147,267
1963	59,670	39,706	99,376	1,812	15,773	17,585	116,961
1964	47,528	43,210	90,738	2,138	23,094	25,232	115,970
1965	15,774	21,087	36,861	5,399	23,266	28,665	65,526
1966	25,514	41,558	67,072	5,866	39,085	44,951	112,023
1967*	12,598	27,057	39,655	7,017	44,055	51,072	90,727
1968‡	12,389	16,028	28,417	7,097	41,954	49,051	77,468

* 1967 preliminary.

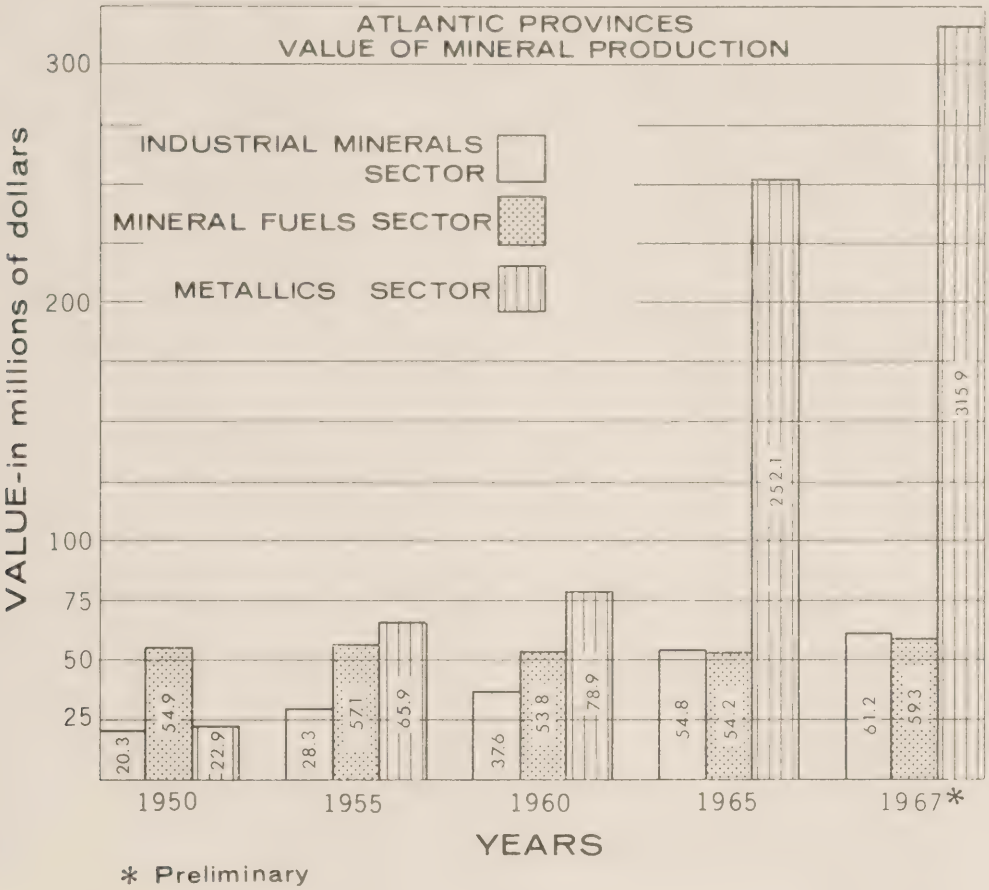
‡ 1968 forecast.

Source: Dominion Bureau of Statistics.

Industry Structure

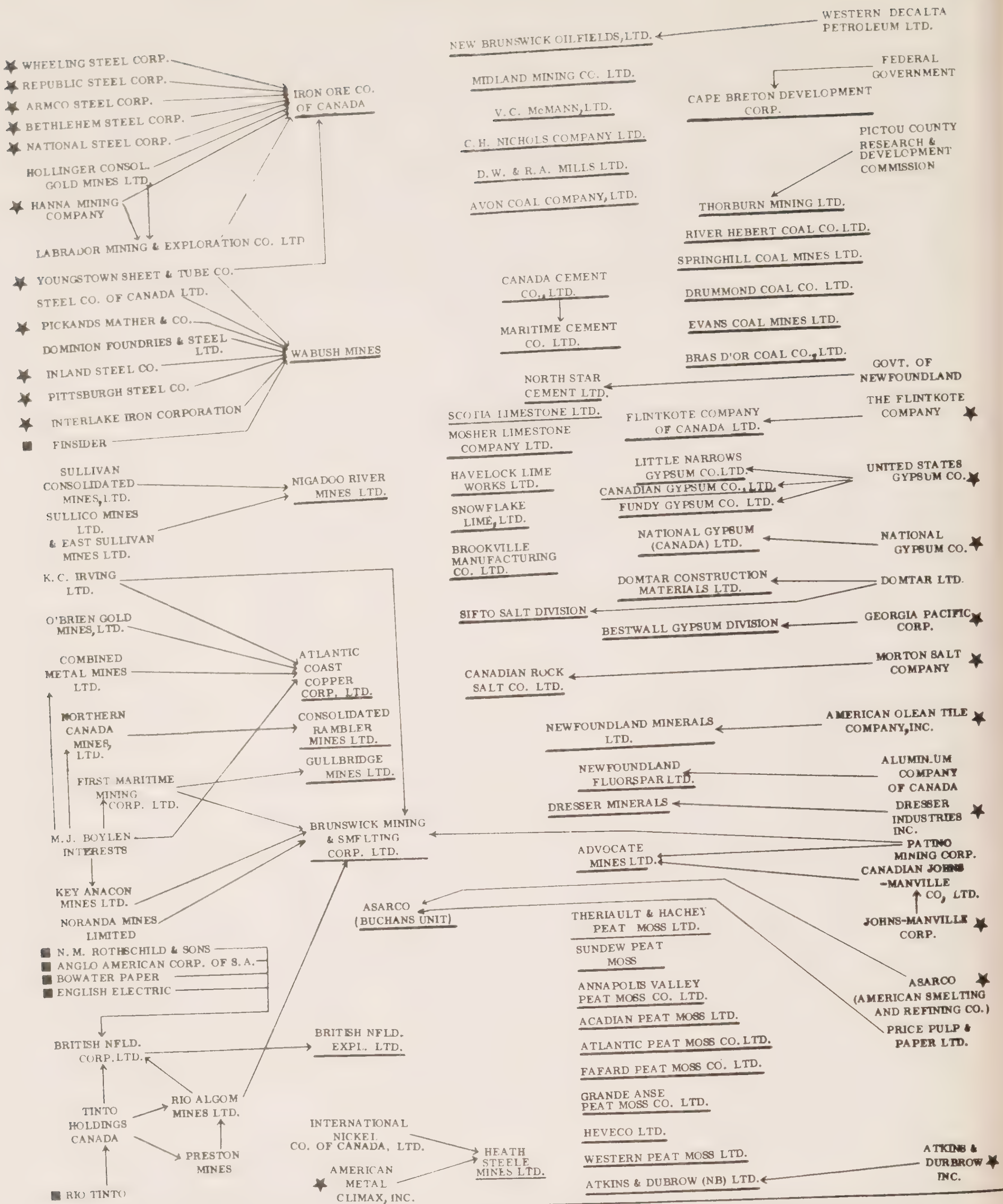
Excluding sand, gravel and crushed stone operations, there are over 50 principal mining operations in the Atlantic Provinces. The most important of these, in terms of value of production, are the metal mines which, as noted previously, produced over 70 per cent of the output value of the region's mineral industry in 1967. The predominant position of the metallics sector within the mineral economy of the Atlantic Provinces is relatively new, having developed largely within the last decade and a half. The trend in the value of mineral production in the Atlantic region is shown in Figure 2-1.

FIGURE 2-1



The principal mining companies operating in the Atlantic Provinces, and the principal corporate participation in these companies, are shown diagramatically in Figure 2-2. It will be noted that many of the companies are controlled by non-Canadian interests or by Canadian interests based outside the region. This aptly demonstrates the dependence of the Atlantic Provinces on foreign capital, or capital from outside the region, to develop a viable mining industry of any magnitude.

FIGURE 2-2



★ UNITED STATES CORPORATION

■ U.K. OR ITALIAN CORPORATION

——— PRODUCER COMPANY

———→ CORPORATE PARTICIPATION

THE ATLANTIC PROVINCES
Corporate Participation In Mining Companies

Provincial Aspect

In 1967 Ontario was Canada's leading mineral-producing province with output valued at $1,197.3 million, 27.2 per cent of Canada's total mineral output. Ontario was followed in order by Alberta with 22.5 per cent of total output, Québec 16.7 per cent, Saskatchewan 8.4 per cent, British Columbia 8.2 per cent, Newfoundland and Labrador 6.1 per cent, and Manitoba 4.2 per cent. The Northwest Territories, Yukon, New Brunswick, Nova Scotia and Prince Edward Island together contributed approximately 6.7 per cent of the 1967 total output.

Newfoundland and Labrador

The value of mineral production in the Province of Newfoundland and Labrador in 1967 was $266.0 million, up 11 per cent from $244.0 million in 1966. Of the total 1967 production, metallics output was valued at $248.0 million, nonmetallics were worth $13.7 million and structural materials output was valued at $4.3 million. There is no production of mineral fuels in the province. Production of iron ore from Labrador, with an estimated value of $210 million, contributed 79.0 per cent of the total value of mineral production. The province accounted for 6.1 per cent of Canada's total mineral output in 1967.

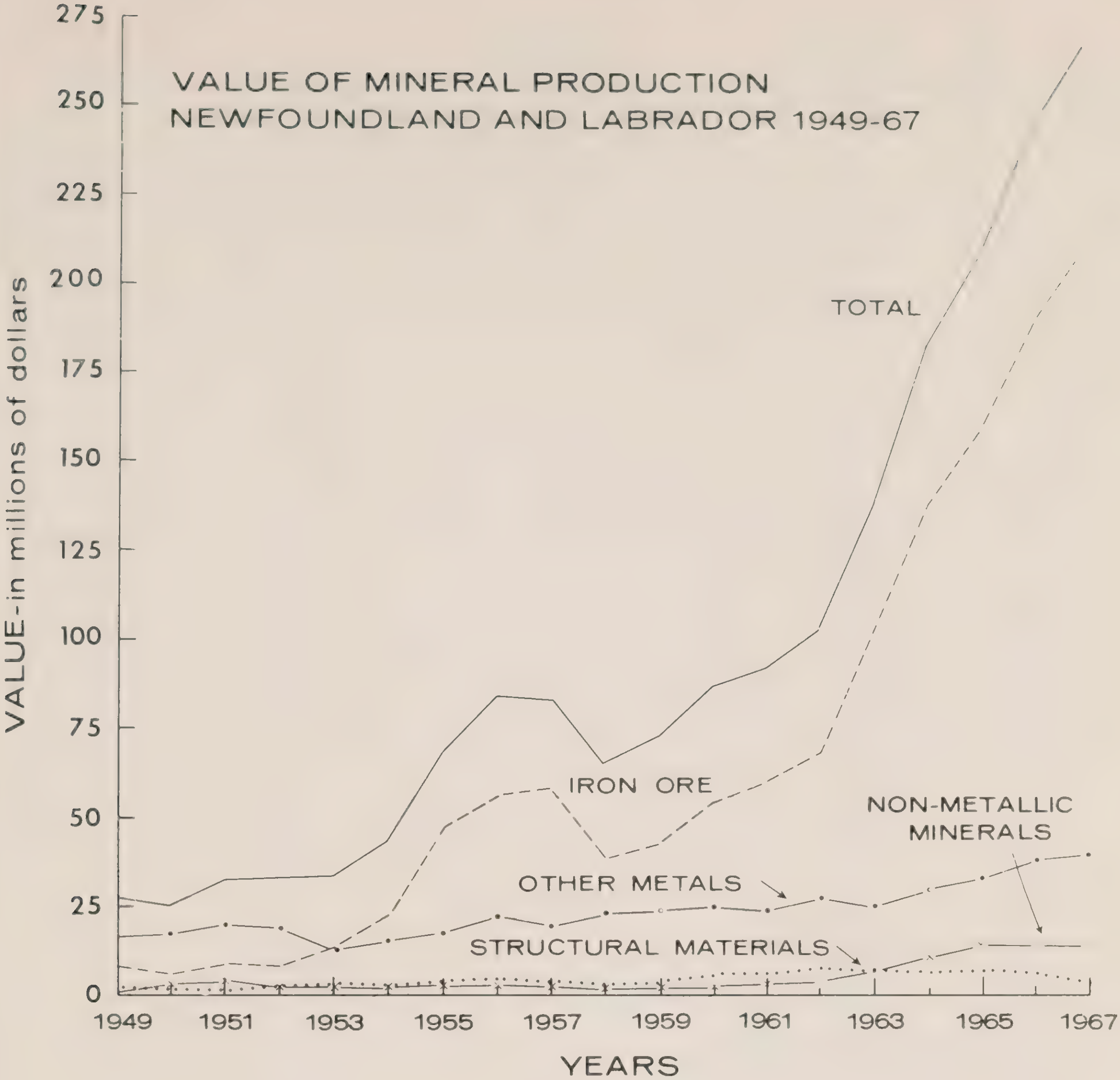
Employment in the mineral industry changed very little in the late 1950's and early 1960's. In 1962 there were 4,421 workers in the industry. Subsequently, there has been an increase, with the estimate for 1967 being 5,700. In 1965 the primary industries of the province, excluding agriculture, contributed 50.0 per cent of the net value of all commodity-producing industries in Newfoundland, with mining accounting for 32.4 per cent of the total. By comparison, construction contributed 28.3 per cent, and manufacturing contributed 21.7 per cent. Total value of industrial production in 1965, the year of latest available data, was $379.1 million. It is estimated that the mineral industry's share of the net value of industrial production has been increasing since then, and in 1968, will probably amount to more than 35 per cent of net value of total industrial output.

It has already been mentioned that the value of iron ore shipments from Labrador in 1967 represents over 79.0 per cent of the total mineral output of the province. All other mineral production, amounting to $56.0 million in 1967 was produced on the Island, with zinc contributing $9.9 million, copper $18.7 million, and lead $6.6 million. Of the industrial minerals, asbestos output was worth $10.2 million, sand and gravel $2.4 million, fluorspar $2.1 million and cement $1.5

million. Minerals, other than iron ore, that have registered substantial increases in value of output in recent years, have been asbestos (with first production in 1963), zinc and, to a lesser extent, lead.

The per-capita value of mineral production in Newfoundland and Labrador in 1967 was $532, which is considerably above the average for Canada of just under $216 in the same year. Advances in the province's mineral output compare favourably with those of other provinces. Newfoundland's rapid strides in mineral output gains have been almost entirely dependent upon iron ore production from Labrador, as indicated in Figure 2-3 and Tables 2-4, 2-5 and 2-6.

FIGURE 2-3


VALUE OF MINERAL PRODUCTION
NEWFOUNDLAND AND LABRADOR 1949-67
VALUE-in millions of dollars
275
250
225
200
175
150
125
100
75
50
25
0
TOTAL
IRON ORE
NON-METALLIC MINERALS
OTHER METALS
STRUCTURAL MATERIALS
1949
1951
1953
1955
1957
1959
1961
1963
1965
1967
YEARS

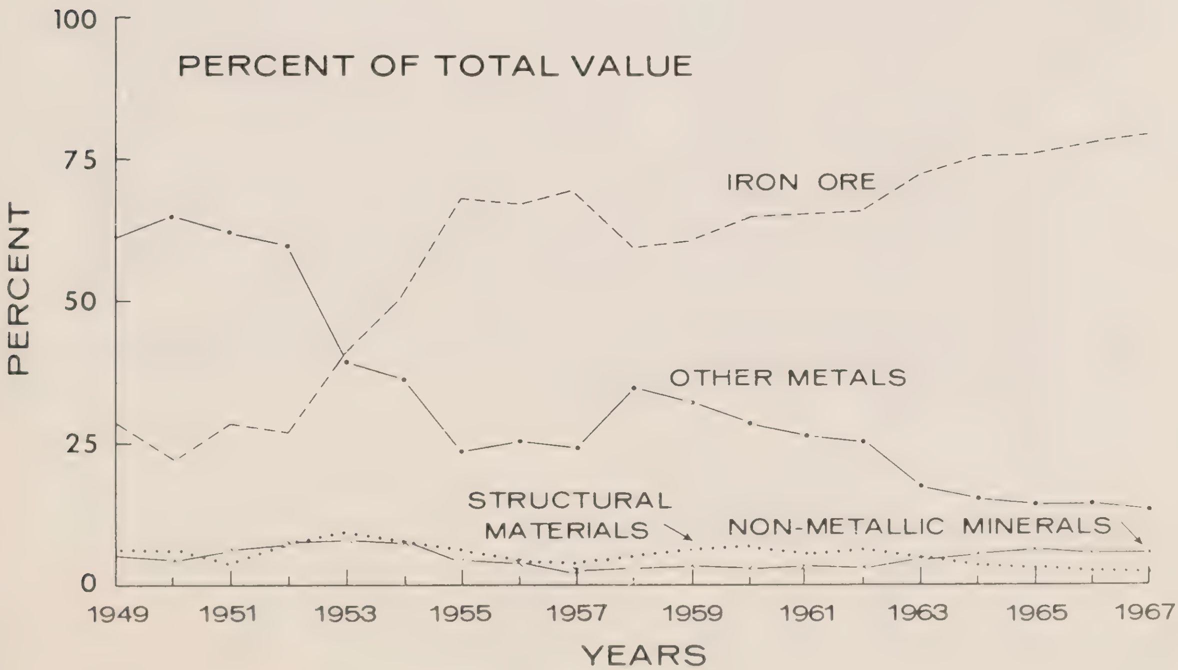

PERCENT OF TOTAL VALUE
PERCENT
100
75
50
25
0
IRON ORE
OTHER METALS
STRUCTURAL MATERIALS
NON-METALLIC MINERALS
1949
1951
1953
1955
1957
1959
1961
1963
1965
1967
YEARS

TABLE 2-4

Newfoundland and Labrador, Mineral Production and Percentage Distribution, by Sector* and Commodity, 1955, 1960, 1965-67

Sector and Commodity	1955 Production	1955 % of Sector	1955 % of Grand Total	1960 Production	1960 % of Sector	1960 % of Grand Total	1965 Production	1965 % of Sector	1965 % of Grand Total	1966 Production	1966 % of Sector	1966 % of Grand Total	1967‡ Production	1967‡ % of Sector	1967‡ % of Grand Total
	$ 000	%	%	$ 000	%	%	$ 000	%	%	$ 000	%	%	$ 000	%	%
Metallics															
Copper	2,251	3.6	3.3	8,398	10.6	9.7	11,147	5.9	5.4	17,415	7.7	7.1	18,733	7.6	7.0
Iron Ore	45,702	74.0	66.8	54,674	69.3	63.1	156,889	83.4	75.6	188,603	83.7	77.3	210,025	84.7	79.0
Lead	5,135	8.3	7.5	5.131	6.5	5.9	6,794	3.6	3.3	6,500	2.9	2.7	6,580	2.6	2.5
Silver	619	1.0	0.9	1,130	1.4	1.3	1,522	0.8	0.7	1,535	0.7	0.6	1,832	0.7	0.7
Zinc	7,817	12.7	11.4	9,134	11.6	10.6	10,929	5.8	5.3	10,317	4.6	4.2	9,882	4.0	3.7
Gold	219	0.4	0.3	459	0.6	0.5	892	0.5	0.4	968	0.4	0.4	925	0.4	0.3
Total	61,743	100.0	90.2	78,926	100.0	91.1	188,173	100.0	90.7	225,338	100.0	92.3	247,977	100.0	93.2
Industrial Minerals															
Nonmetallics															
Asbestos	-	-	-	-	-	-	8,825	45.5	4.3	9,301	49.8	3.8	10,234	56.8	3.8
Fluorspar	2,679	39.9	3.9	1,821	23.6	2.1	2,677	13.8	1.3	1,891	10.1	0.8	2,097	11.7	0.8
Gypsum	176	2.6	0.3	141	1.8	0.2	1,089	5.6	0.5	1,174	6.3	0.5	937	5.2	0.4
Soapstone, Talc and Pyrophyllite	-	-	-	263	3.4	0.3	452	2.4	0.2	608	3.2	0.2	450	2.5	0.2
Sulphur in Smelter Gas	66	1.0	0.1	-	-	-	-	-	-	-	-	-	6	..	..
Sub-Total	2,921	43.5	4.3	2,225	28.8	2.6	13,043	67.3	6.3	12,974	69.4	5.3	13,724	76.2	5.2
Structural Materials															
Cement	1,493	22.2	2.1	1,689	21.9	2.0	1,987	10.2	1.0	1,633	8.8	0.7	1,532	8.5	0.6
Clay Products	49	0.7	0.1	83	1.1	0.1	73	0.4	..	173	0.9	0.1	281	1.6	0.1
Sand and Gravel	1,661	24.7	2.4	3,069	39.8	3.5	3,785	19.5	1.8	3,584	19.2	1.5	2,380	13.2	0.9
Stone	596	8.9	0.9	645	8.4	0.7	497	2.6	0.2	318	1.7	0.1	95	0.5	..
Sub-Total	3,799	56.5	5.5	5,486	71.2	6.3	6,342	32.7	3.0	5,708	30.6	2.4	4,288	23.8	1.6
Total	6,720	100.0	9.8	7,711	100.0	8.9	19,385	100.0	9.3	18,682	100.0	7.7	18,012	100.0	6.8
GRAND TOTAL	68,463		100.0	86,637		100.0	207,558		100.0	244,020		100.0	265,989		100.0

* The mineral industry is comprised of three sectors - metallics, industrial minerals and mineral fuels. The industrial minerals sector consists of two groups: non-metallics and structural materials.

‡ Preliminary.

TABLE 2-5

Canada and Newfoundland and Labrador, Mineral Production Value, and Per-Capita Value of Mineral Production, Selected Years, 1949-1967

Year	Value of Mineral Prod.			Per-Capita Value of Mineral Prod.		
	Canada	Newfoundland	Nfld. as % of Can.	Canada	Newfoundland	Nfld. as % of Can.
	---- $ 000,000 ----		%	$	$	%
1949	901.1	27.6	3.1	41.32	79.95	193.5
1950	1,045.5	25.8	2.5	76.25	73.57	96.5
1955	1,795.3	68.5	3.8	114.36	168.63	147.5
1960	2,492.5	86.6	3.5	139.48	193.39	138.7
1965	3,745.5	207.6	5.5	190.67	425.32	223.1
1966	3,972.8	244.0	6.1	198.49	494.97	249.4
1967*	4,405.1	266.0	6.0	215.88	531.98	246.4

* Preliminary.

Source: Dominion Bureau of Statistics.

TABLE 2-6

Newfoundland and Labrador, Mineral Production and Growth Rates, by Sector*, 1950, 1955, 1960, 1965-67

Minerals	Production						Av. Annual Compound Growth Rates			
	1950	1955	1960	1965	1966	1967‡	1950-65	1955-65	1960-65	1960-67
	---- $ 000 ----						%	%	%	%
Metallics	22,915	61,743	78,926	188,173	225,338	247,977	15.1	11.8	19.0	17.8
Industrial Minerals	2,909	6,720	7,711	19,385	18,682	18,012	13.5	11.2	20.0	12.9
Nonmetallics	1,290	2,921	2,225	13,043	12,974	13,724	16.7	16.2	42.0	30.0
Structural Materials	1,619	3,799	5,486	6,342	5,708	4,288	9.5	5.3	3.0	-3.6
Total	25,824	68,463	86,637	207,558	244,020	265,989	14.9	11.7	19.1	17.4
Canada	1,045,500	1,795,300	2,492,500	3,745,500	3,972,800	4,405,100	8.9	7.6	8.5	8.5

* The mineral industry is comprised of three sectors - metallics, industrial minerals and mineral fuels. The industrial minerals sector consists of two groups - nonmetallics and structural materials.

‡ Preliminary.

Source: Dominion Bureau of Statistics.

New Brunswick

The value of mineral production in New Brunswick in 1967 was $89.7 million compared with $90.2 million the previous year. Of the total 1967 production, metallics output was valued at $67.6 million, industrial minerals at $14.5 million and mineral fuels were worth $7.6 million. In the industrial minerals sector, structural materials were valued at $12.4 million and nonmetallics were valued at $2.1 million. The province contributed 2.0 per cent of Canada's total mineral production in 1967.

The metallics sector now contributes about 75.4 per cent of the province's total mineral output with zinc accounting for 49.7 per cent and lead, 14.2 per cent of metallics output. In 1960 there was no record of production of metallic minerals in New Brunswick; there had been sporadic production since before the turn of the century. This sector of the industry has been of prominence only since 1964 and is the only sector which gives promise of steady expansion in the years ahead.

The growth of the structural materials group of industrial minerals is dependent upon the rate of building transportation routes and facilities, and the amount of industrial and residential construction. It has, essentially, risen in value of output in parallel to the economic growth. Peat moss, valued at about $1.5 million, makes up nearly all of the nonmetallics output.

Coal output from strip and underground mines was worth $7.5 million in 1967, or nearly 99 per cent of total mineral fuels output. Most of the remainder has been natural gas from the Stoney Creek field near Moncton, output from which has been declining steadily in recent years.

Employment in the mineral industry as recently as 1964 was under 2,000, but with the start of substantial base metal output beginning in that year, employment rose to 2,600 in 1967, about half being engaged in base metal operations. The mineral industry is not a large employer of manpower in relation to its value of output. For instance, even though Canada's total value of mineral output increased four times from just over $1 billion in 1950 to $4.4 billion in 1967, employment increased only from about 110,000 to 130,000. This trend of greater value of output per employee will continue as improved methods of mining, transport and milling are adopted with increased use of mechanization and automation.

In 1960 the primary industries[1/] of the province produced goods having total value of $100.4 million. Secondary industries[2/] produced goods having a value of $238.1 million,

---

1/ Agriculture, forestry, fisheries, trapping and mining plus electric power.

2/ Manufacturing and construction.

which was 70 per cent of the total. In 1960 mineral output, valued at $7.9 million, was 2.3 per cent of the value of output of both the primary and secondary industries. Comparative figures for mining in more recent years were: 1963, $11.3 million and 3.3 per cent; 1967, $89.7 million and an estimated 8 per cent. The proportion of the total value of output in New Brunswick represented by the mining industry will continue to rise.

The per-capita value of mineral production in New Brunswick in 1967 was $144.66 compared with $215.88 for Canada. The comparative per-capita values in 1945 were $8.96 and $41.31; in 1955 they were $28.81 and $114.37. As recently as 1960 the respective per-capita values were $28.99 and $139.48 with New Brunswick's per-capita value of mineral production being only 20.8 per cent of Canada's. The dramatic narrowing of the gap between the two values was brought about entirely by the start of base metal production in 1962 by Heath Steele Mines Limited and was greatly accelerated in 1965 when first substantial production was recorded by Brunswick Mining and Smelting Company Limited west of Bathurst. This is illustrated in Figure 2-4 and the accompanying Tables 2-7, 2-8 and 2-9.

FIGURE 2-4

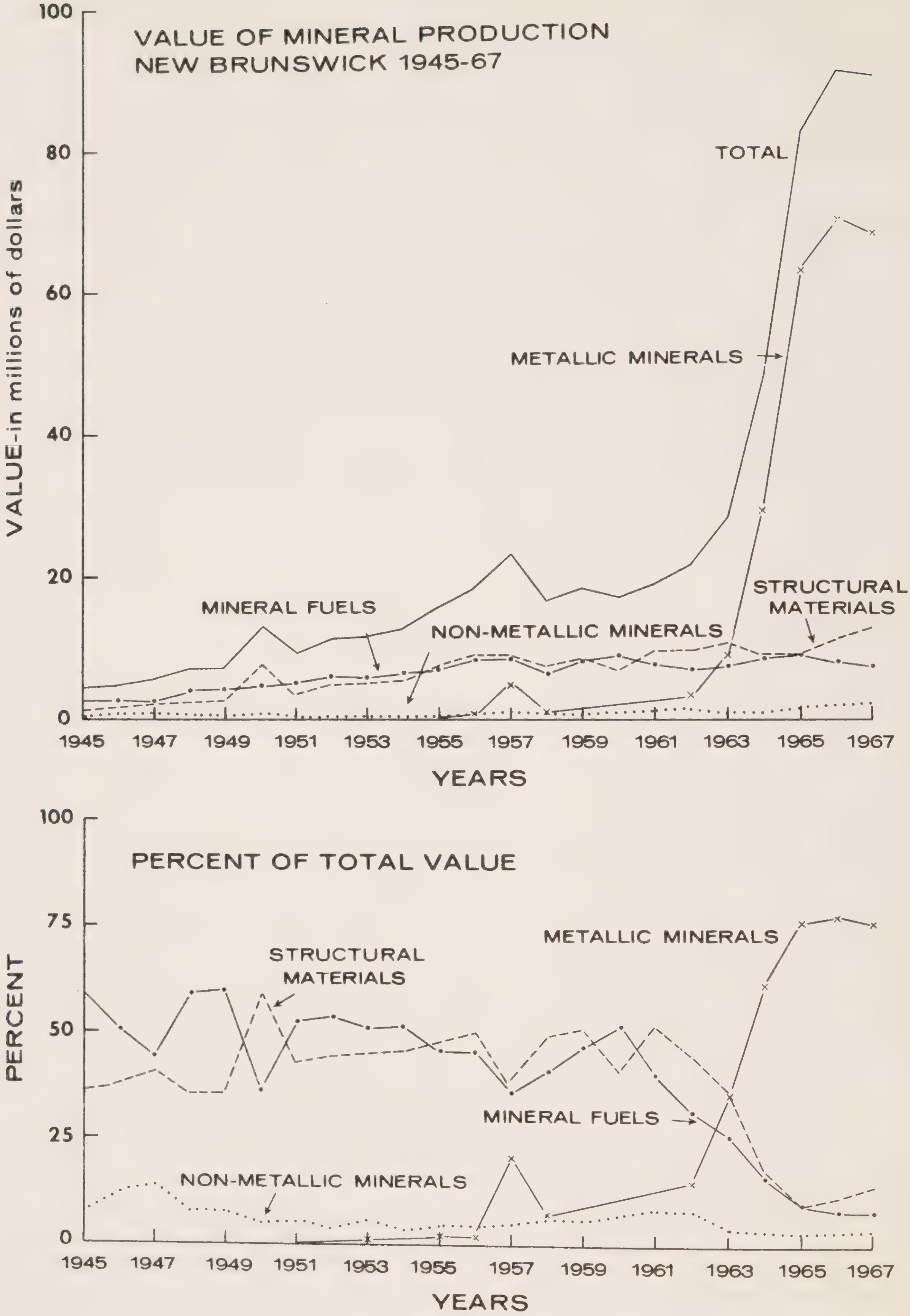

VALUE OF MINERAL PRODUCTION
NEW BRUNSWICK 1945-67
VALUE-in millions of dollars
100
80
60
40
20
0
TOTAL
METALLIC MINERALS
STRUCTURAL MATERIALS
MINERAL FUELS
NON-METALLIC MINERALS
1945
1947
1949
1951
1953
1955
1957
1959
1961
1963
1965
1967
YEARS
PERCENT OF TOTAL VALUE
PERCENT
100
75
50
25
0
METALLIC MINERALS
STRUCTURAL MATERIALS
MINERAL FUELS
NON-METALLIC MINERALS
YEARS

TABLE 2-7

New Brunswick Mineral Production and Percentage Distribution, by Sector* and Commodity, 1955, 1960, 1965-67

Sector and Commodity	1955 Production	1955 % of Sector	1955 % of Grand Total	1960 Production	1960 % of Sector	1960 % of Grand Total	1965 Production	1965 % of Sector	1965 % of Grand Total	1966 Production	1966 % of Sector	1966 % of Grand Total	1967‡ Production	1967‡ % of Sector	1967‡ % of Grand Total
	$ 000	%	%	$ 000	%	%	$ 000	%	%	$ 000	%	%	$ 000	%	%
Metallics															
Copper	26	8.3	0.2	-	-	-	7,581	12.1	9.2	6,366	9.2	7.0	5,336	7.9	5.9
Lead	220	69.8	1.4	-	-	-	13,533	21.7	16.5	15,497	22.3	17.2	12,701	18.8	14.2
Silver	22	7.0	0.1	-	-	-	3,843	6.2	4.7	4,349	6.3	4.8	4,830	7.1	5.4
Zinc	-	-	-	-	-	-	37,326	59.8	45.4	43,003	62.0	47.7	44,548	65.9	49.7
Others	48	14.9	0.3	-	-	-	178	0.2	0.2	171	0.2	0.2	208	0.3	0.2
Total	316	100.0	2.0	-	-	-	62,461	100.0	76.0	69,386	100.0	76.9	67,623	100.0	75.4
Industrial Minerals															
Nonmetallics															
Gypsum	315	3.8	2.0	267	3.2	1.6	211	1.9	0.3	413	3.2	0.5	245	1.7	0.3
Peat Moss	235	2.9	1.6	833	10.2	4.9	1,532	14.0	1.9	1,480	11.6	1.6	1,543	10.7	1.7
Sulphur in Smelter Gas	-	-	-	-	-	-	-	-	-	-	-	-	310	2.1	0.3
Others	2	..	..	2	..	..	1	..	..	2	..	..	3	..	..
Sub-Total	552	6.7	3.6	1,102	13.4	6.5	1,744	15.9	2.2	1,895	14.8	2.1	2,101	14.5	2.3
Structural Materials															
Cement	2,306	28.2	14.6	2,547	30.9	14.9	2,940	26.8	3.6	4,141	32.3	4.6	4,043	28.0	4.5
Clay Products	704	8.6	4.5	705	8.6	4.1	668	6.1	0.8	619	4.8	0.7	569	3.9	0.6
Lime	386	4.7	2.4	379	4.6	2.2	101	0.9	0.1	100	0.8	0.1	79	0.5	0.1
Sand and Gravel	2,943	35.9	18.7	2,091	25.4	12.2	2,639	24.1	3.2	2,990	23.3	3.3	4,450	30.8	5.0
Stone	1,296	15.9	8.2	1,414	17.1	8.4	2,862	26.2	3.5	3,084	24.0	3.4	3,223	22.3	3.6
Sub-Total	7,635	93.3	48.4	7,136	86.6	41.8	9,210	84.1	11.2	10,934	85.2	12.1	12,364	85.5	13.8
Total	8,187	100.0	52.0	8,238	100.0	48.3	10,954	100.0	13.4	12,829	100.0	14.2	14,465	100.0	16.1
Mineral Fuels															
Coal	7,101	97.8	45.1	8,663	98.1	50.7	8,638	98.8	10.5	7,892	98.5	8.8	7,490	98.6	8.4
Natural Gas	138	1.9	0.8	152	1.7	0.9	100	1.1	0.1	93	1.2	0.1	83	1.1	0.1
Petroleum	18	0.3	0.1	20	0.2	0.1	6	0.1	..	21	0.3	..	26	0.3	..
Total	7,257	100.0	46.0	8,835	100.0	51.7	8,743	100.0	10.6	8,006	100.0	8.9	7,599	100.0	8.5
GRAND TOTAL	15,760		100.0	17,073		100.0	82,158		100.0	90,221		100.0	89,687		100.0

* The mineral industry is comprised of three sectors - metallics, industrial minerals and mineral fuels. The industrial mineral sector consists of two groups: non-metallics and structural materials.

‡ Preliminary.

Source: Dominion Bureau of Statistics.

TABLE 2-8

Canada and New Brunswick, Mineral Production Value, and Per-Capita Value of Mineral Production, Selected Years, 1945-1967

Year	Value of Mineral Prod. Canada	New Brunswick	N.B. as % of Can.	Per-Capita Value of Mineral Prod. Canada	New Brunswick	N.B. as % of Can.
	----- $ 000,000 -----		%	$	$	%
1945	498.8	4.2	0.8	41.31	8.96	21.7
1950	1,045.5	12.8	1.2	76.24	24.92	32.7
1955	1,795.3	15.8	0.9	114.37	28.81	25.2
1960	2,492.5	17.1	0.7	139.48	28.99	20.8
1965	3,745.5	82.2	2.2	190.67	133.59	70.1
1966	3,972.8	90.2	2.3	198.49	146.23	73.7
1967*	4,405.1	89.7	2.0	215.88	144.66	67.0

* Preliminary.

Source: Dominion Bureau of Statistics.

TABLE 2-9

New Brunswick, Mineral Production and Growth Rates, by Sector*, 1950, 1955, 1960, 1965-67

Minerals	Production 1950	1955	1960	1965	1966	1967‡	Av. Annual Compound Growth Rates 1950-65	1955-65	1960-65	1960-67
	------	------	------	$ 000	------	------	%	%	%	%
Metallics	-	316	-	62,461	69,386	67,623	-	70.0	-	-
Industrial Minerals	8,147	8,187	8,238	10,954	12,829	14,465	2.0	3.0	5.9	8.4
Nonmetallics	550	552	1,102	1,744	1,895	2,101	8.0	12.2	9.6	9.7
Structural Materials	7,597	7,635	7,136	9,210	10,934	12,364	1.3	1.9	5.2	8.2
Mineral Fuels	4,610	7,257	8,835	8,743	8,006	7,599	4.4	1.9	-2.1	-2.2
Total	12,757	15,760	17,073	82,158	90,221	89,687	13.2	18.0	37.0	27.0
Canada	1,045,500	1,795,300	2,492,500	3,745,500	3,972,800	4,405,100	8.9	7.6	8.5	8.5

* The mineral industry is comprised of three sectors - metallics, industrial minerals and mineral fuels. The industrial minerals sector consists of two groups: nonmetallics and structural materials.

‡ Preliminary.

Source: Dominion Bureau of Statistics.

Nova Scotia

The value of mineral production in Nova Scotia in 1967 was $79.0 million compared with $85.4 million the previous year. Of the total 1967 production, metallics output was valued at $0.3 million, industrial minerals at $27.0 million, and coal was worth $51.7 million. In the industrial minerals sector, structural materials were valued at $14.2 million and nonmetallics at $12.8 million. The province contributed 1.8 per cent of Canada's total mineral production. Compared with 1966, the dollar value of barite production declined 24.8 per cent in 1967, gypsum was down 12.8 per cent, and salt was down 12.1 per cent.

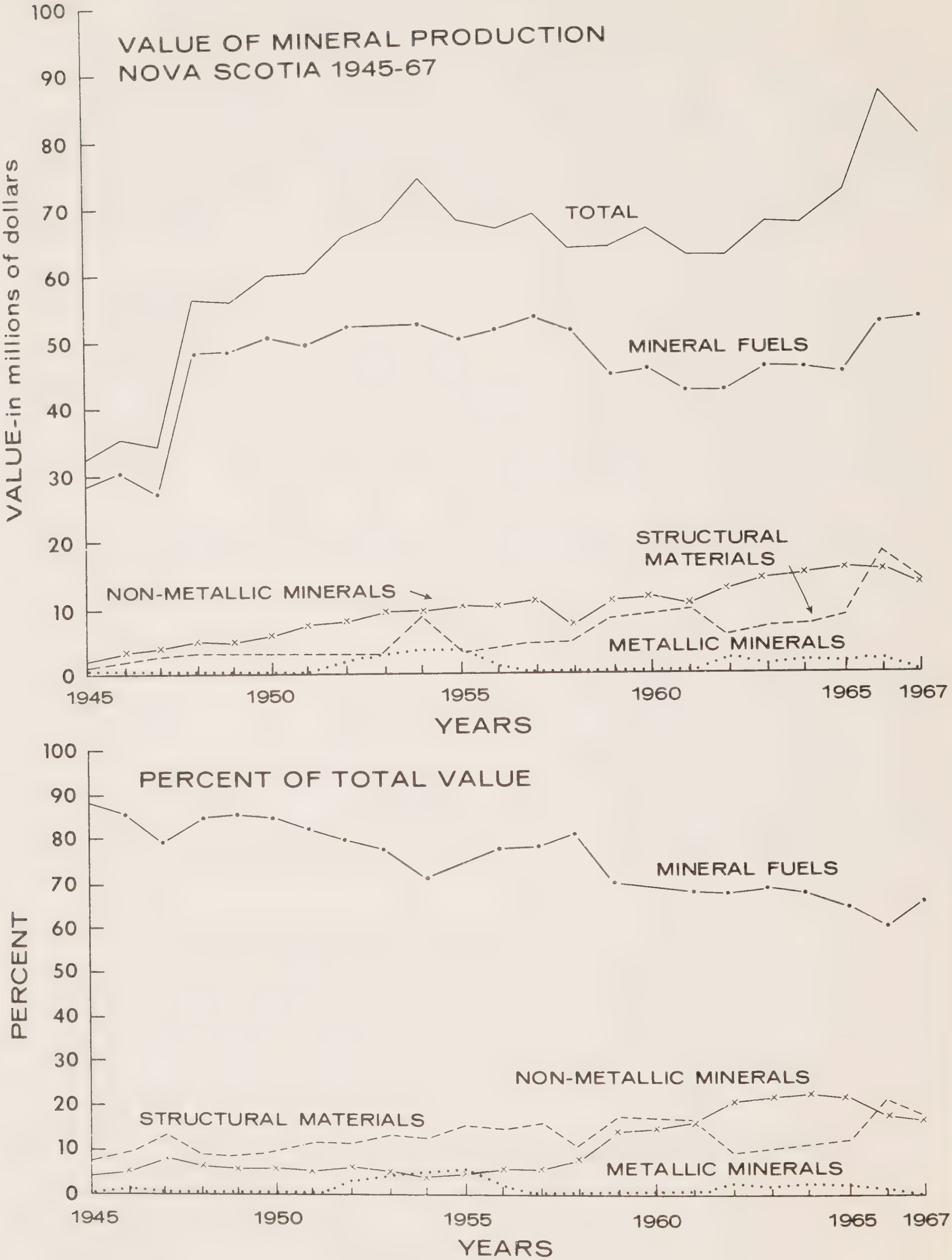
For over 60 years the metallics sector has made only a minor contribution to the total provincial mineral output. In 1967, output from the province's single base metals producer amounted to 0.4 per cent of total value, a decline from 2.0 per cent of the total in 1965. There are at present two prospects for base metals of promise under investigation, and exploration for metals has been active in recent years. The geological environment of Nova Scotia is such that modern exploration technology may well result in new metallic discoveries.

The output of the industrial minerals sector has increased in value in recent years with the structural materials group advancing from 12.1 per cent of total production in 1965 to 20.2 per cent in 1966, although it declined to 17.9 per cent in 1967. The recently-established cement industry, together with construction demands, has increased the output value of structural materials to 52.5 per cent of the industrial minerals sector. Consequently, the percentage share of the important gypsum industry within the industrial minerals sector has fallen from 36.2 per cent in 1965 to 26.3 per cent in 1967 and its premier position within the sector was replaced in 1966 and 1967 by sand and gravel production. Of the nonmetallics, gypsum, salt and barite together have been the mainstay of the Nova Scotia industrial minerals industry for many years and it is anticipated that they will continue to form its main base in the years to come.

Coal output was worth $51.7 million in 1967, making up 65.4 per cent of the total value of mineral production. Of total mineral production, the coal sector has steadily declined from 84.5 per cent in 1950 to 60.3 per cent in 1966. It increased to 65.4 per cent in 1967 because of decreased production of other minerals as indicated in Figure 2-5 and Tables 2-10, 2-11 and 2-12.

The per-capita value of mineral production in 1967 was $104.38 compared with $215.88 for Canada. There has been a decline in Nova Scotia's per-capita value of mineral production from a value 25.9 per cent above Canada's per-capita value in 1945 to 51.6 per cent below in 1967. This trend is likely to continue in the light of the over-all growth of the Canadian mineral industry compared with the possibilities of growth that appear to be present in Nova Scotia.

FIGURE 2-5



VALUE OF MINERAL PRODUCTION
NOVA SCOTIA 1945-67
VALUE-in millions of dollars
100
90
80
70
60
50
40
30
20
10
0
TOTAL
MINERAL FUELS
STRUCTURAL
MATERIALS
NON-METALLIC MINERALS
METALLIC MINERALS
1945
1950
1955
1960
1965
1967
YEARS
PERCENT OF TOTAL VALUE
PERCENT
MINERAL FUELS
NON-METALLIC MINERALS
STRUCTURAL MATERIALS
METALLIC MINERALS
YEARS

Nova Scotia, Mineral Production and Percentage Distribution, by Sector* and Commodity, 1955, 1960, 1965-67

Sector and Commodity	1955 Production	1955 % of Sector	1955 % of Grand Total	1960 Production	1960 % of Sector	1960 % of Grand Total	1965 Production	1965 % of Sector	1965 % of Grand Total	1966 Production	1966 % of Sector	1966 % of Grand Total	1967‡ Production	1967‡ % of Sector	1967‡ % of Grand Total
	$ 000	%	%	$ 000	%	%	$ 000	%	%	$ 000	%	%	$ 000	%	%
Metallics															
Copper	758	19.5	1.1	-	-	-	140	9.8	0.2	104	6.9	0.1	38	12.0	-
Lead	572	14.7	0.9	-	-	-	571	40.1	0.8	445	29.5	0.5	110	34.8	0.1
Silver	231	6.0	0.3	-	-	-	621	43.7	0.9	756	50.1	0.9	155	49.1	0.2
Zinc	2,189	56.4	3.3	-	-	-	90	6.4	0.1	205	13.6	0.2	13	4.1	-
Gold	134	3.5	0.2	-	-	-	-	-	-	1	-	-	-	-	-
Total	3,884	100.0	5.8	-	-	-	1,423	100.0	2.0	1,510	100.0	1.8	316	100.0	0.4
Industrial Minerals															
Nonmetallics															
Barite	2,038	15.2	3.0	1,242	6.1	1.9	1,984	8.4	2.8	2,023	6.2	2.4	1,522	5.6	1.9
Gypsum	6,062	45.3	9.0	7,515	36.7	11.5	8,620	36.2	12.2	8,141	25.1	9.5	7,100	26.3	9.0
Peat Moss	8	0.1	-	69	0.3	0.1	103	0.4	0.1	197	0.6	0.2	-	-	-
Salt	1,808	13.5	2.7	2,256	11.0	3.5	4,608	19.3	6.5	4,725	14.6	5.5	4,152	15.4	5.3
Silica Brick	289	2.2	0.4	-	-	-	-	-	-	-	-	-	-	-	-
Quartz	-	-	-	53	0.3	0.1	-	-	-	40	0.1	-	48	0.2	0.1
Sub-Total	10,206	76.2	15.2	11,135	54.5	17.0	15,315	64.2	21.6	15,125	46.7	17.7	12,822	47.5	16.2
Structural Materials															
Cement	-	-	-	-	-	-	765	3.2	1.1	3,144	9.7	3.7	3,517	13.0	4.5
Clay Products	1,197	8.9	1.8	1,674	8.2	2.6	1,828	7.6	2.6	1,525	4.7	1.8	1,374	5.1	1.7
Sand and Gravel	1,148	8.6	1.7	6,020	29.4	9.2	4,563	19.1	6.5	10,756	33.2	12.6	7,630	28.2	9.7
Stone	846	6.3	1.3	1,643	8.0	2.5	1,391	5.8	2.0	1,838	5.7	2.2	1,679	6.2	2.1
Sub-Total	3,191	23.8	4.8	9,337	45.5	14.3	8,548	35.8	12.1	17,263	53.3	20.2	14,200	52.5	18.0
Total	13,397	100.0	20.0	20,472	100.0	31.3	23,863	100.0	33.7	32,388	100.0	37.9	27,022	100.0	34.2
Mineral Fuels															
Coal	49,853	100.0	74.3	44,981	100.0	68.7	45,487	100.0	64.3	51,519	100.0	60.3	51,681	100.0	65.4
GRAND TOTAL	67,134		100.0	65,454		100.0	70,772		100.0	85,417		100.0	79,019		100.0

* The mineral industry is comprised of three sectors - metallics, industrial minerals and mineral fuels. The industrial minerals sector consists of two groups: non-metallics and structural materials.

‡ Preliminary.

Source: Dominion Bureau of Statistics.

TABLE 2-11

Canada and Nova Scotia, Mineral Production Value, and Per-Capita Value of Mineral Production, Selected Years, 1945-1967

	Value of Mineral Prod.			Per-Capita Value of Mineral Prod.		
Year	Canada	Nova Scotia	N.S. as % of Can.	Canada	Nova Scotia	N.S. as % of Can.
	--- $ 000,000 ---		%	$	$	%
1945	498.8	32.2	6.5	41.32	52.02	125.90
1950	1,045.5	59.5	5.7	76.25	93.26	122.30
1955	1,795.3	67.1	3.7	114.36	98.24	85.90
1960	2,492.5	65.5	2.6	139.48	90.10	64.60
1965	3,745.5	70.8	1.9	190.67	93.65	49.10
1966	3,972.8	85.4	2.1	198.49	112.99	56.90
1967	4,405.1	79.0	1.8	215.88	104.38	48.35

Source: Dominion Bureau of Statistics.

TABLE 2-12

Nova Scotia, Mineral Production and Growth Rates, by Sector*, 1950, 1955, 1960, 1965-67

	Production						Av. Annual Compound Growth Rates			
Minerals	1950	1955	1960	1965	1966	1967‡	1950-65	1955-65	1960-65	1960-67
	--- $ 000 ---						%	%	%	%
Metallics	2	3,884	-	1,423	1,510	316	..	..	..	..
Industrial Minerals	9,224	13,397	20,472	23,863	32,388	27,022	6.5	5.9	3.1	4.0
Nonmetallics	5,853	10,206	11,135	15,315	15,125	12,822	6.6	4.2	6.6	2.1
Structural Materials	3,371	3,191	9,337	8,548	17,263	14,200	6.4	10.3	-1.8	6.2
Mineral Fuels	50,256	49,853	44,981	45,487	51,519	51,681	-0.7	-0.9	0.2	2.0
Total	59,482	67,134	65,454	70,772	85,417	79,019	1.2	0.5	1.6	2.7
Canada	1,045,500	1,795,300	2,492,500	3,745,500	3,972,800	4,405,100	8.9	7.6	8.5	8.5

* The mineral industry is comprised of three sectors - metallics, industrial minerals and mineral fuels. The industrial minerals sector consists of two groups: nonmetallics and structural materials.

‡ Preliminary.

Source: Dominion Bureau of Statistics.

Prince Edward Island

Except for a relatively small production of sand, gravel and crushed stone, Prince Edward Island is not a mineral-producing province. In this respect it is unlike all other provinces of Canada in each of which the mineral industry is a key industry and an important sector of each province's economy.

Prince Edward Island's production record over the past five years is summarized in Table 2-13.

TABLE 2-13

Prince Edward Island, Mineral Production and Value, 1963-67

Mineral	Unit	1963	1964	1965	1966	1967*
Sand & gravel	000 tons‡	600.3	608.9	412.1	4,990.0#	950.0
	000 $	563.6	481.3	374.1	2,556.8	1,404.0
Crushed stone	000 tons‡	225.0	350.0	225.3	200.0	300.0
	000 $	225.0	350.0	225.3	200.0	300.0

* Preliminary. ‡ Short tons.

The unusual increase in sand and gravel production in 1966 was caused by greatly increased road construction activity.

Source: Dominion Bureau of Statistics.

3. MINERAL MARKETS

Mineral production of the Atlantic Provinces, with ready access to ocean transport, is favourably located for low-cost transportation to foreign mineral markets. Historically the United States has been, and continues to be, the principal market for the region's mineral production. Other markets include Canada, England, France, Belgium, the Netherlands, West Germany, Venezuela, Australia and Japan.

In terms of value, the bulk of the mineral production of the Atlantic Provinces is marketed outside the region. This is particularly true with respect to the high-value production of the metallics sector, and to a large degree with respect to nonmetallics production as well. In contrast, production of structural materials, characteristically of low unit value, is marketed almost exclusively within the four provinces. Production from the mineral fuels sector, principally coal, goes to markets in the Atlantic Provinces, Ontario and Québec. In 1967, 54.2 per cent of Nova Scotia's coal production went to markets in Ontario and Québec; 10.9 per cent of New Brunswick's coal production went to markets in Québec. The production of natural gas and crude petroleum is very minor and is marketed entirely within the region.

The succeeding sections describe in more detail, on a commodity basis, the marketing of mineral production from the Atlantic Provinces.

Metallics Sector, Ferrous Group

Iron Ore

The iron ore trade of Canada closely parallels that of the whole of North America in that about 90 per cent of all ore traded is on the owner-producer, owner-consumer basis. In other words, the producer and the consumer are captive to the same corporation(s). This situation is not the same as in the other two major non-communist world markets, namely Britain and Western Europe, and Japan, where the bulk of iron ore requirements are purchased on the open market (merchant ore) with little or no corporate connection between producer and consumer. Without discussing the merits of each system it is safe to say that the Canadian iron ore industry would not have approached its present status had it been necessary to develop it independently of the United States steel industry. Because of economics relative to production and marketing, shipping distances and established

trading patterns, "merchant" iron ore from South America, South Africa and Australia effectively limits the sale of Canadian merchant ore in most world markets. This includes the east coast of the United States.

Some iron ore sales in North America that appear to be merchant sales are, in reality, only trades between owner-producer and other owner-consumer groups. This type of trading often occurs to reduce transportation costs if, for example, some of the consuming plants of one group are closer to some of the iron ore sources of a second group and vice versa.

The general pattern of iron ore markets that exists in North America is also applicable in Canada. This is particularly so for the iron ore markets of production from Labrador, the only area of the Atlantic Provinces in which iron ore is now produced (although there is a long history of past iron ore mining in other areas of the region). It is unlikely that large-scale iron ore production will take place even in the distant future on the Island of Newfoundland, or in Nova Scotia and New Brunswick. Production of a small amount of byproduct iron ore or reduced iron ore might occur, but such production would be of minor significance to the region as a whole.

The growth rate of the iron ore industry in Labrador is almost entirely dependent upon the iron ore requirements of the owner-companies in the United States and Canada, and the relative economics governing the delivered cost of the ore to their steel plants in comparison with iron ore from other available sources. There is no official forecast for the growth rate for steel production in the United States for the next 10 or 15 years, but a generally accepted rate is 2 per cent a year; the growth rate for the Canadian steel industry will probably be higher. The ratio of iron ore consumption to ingot production is generally constant, so that the growth rate for iron ore demands should also be in the order of 2 per cent a year, or lower as technological advance results in the preparation and utilization of higher "Fe-content" furnace feeds.

With the foregoing in mind, and assuming that the relative economic factors such as transportation and production costs, and political-fiscal policies remain favourable, the growth rate of iron ore shipments from Labrador should also hold at about 2 per cent a year. However, this will not be a gradual growth rate, but will move from plateau to plateau as new expansion facilities are added. The expansion of pellet production facilities at Iron Ore Company of Canada and Wabush during 1967, for example, increased annual pellet capacity from 10.4 million tons to 16.0 million tons, an increase of almost 52 per cent. The increase in pellet shipments will, however, be partly compensated for by a reduction in the shipments of concentrates and perhaps of direct-shipping ores.

Labrador

Iron Ore Company of Canada

The Iron Ore Company of Canada (IOC) has two mining operations - the Carol operation, which is entirely in Labrador, and the Schefferville operation which draws ore from both Québec and Labrador. Associated with the Carol mining operation is the Carol pellet plant, also in Labrador.

The Schefferville operation commenced marketing of direct-shipping ore in 1954, and by the end of 1967, 49.5 million long tons1/ of direct-shipping ore had been shipped from the Labrador mines. Of this total, the greater portion, amounting to 35 million tons, was shipped to the company's owner-companies in the United States. Other destinations included Britain, Western Europe and Canada, in that order. The value of this ore is in the order of $10.25 a ton f.o.b. Sept Iles, Québec. Production capacity as of December 31, 1967, was 7 million tons a year.

The Carol Pellet Company began shipping concentrates and pellets in 1962, and had shipped 29.8 million tons by the end of 1967. The greater portion, amounting to 21.5 million tons, was shipped to the company's owner-companies in the United States. Other destinations included Britain, Western Europe and Canada in that order of importance. The value of this ore is $15.00 a ton f.o.b. Sept Iles, Québec. Production capacity as of December 31, 1967 was 10 million tons a year.

Table 3-1 and 3-2 show IOC's total shipments from Labrador of direct-shipping ore, and concentrates and pellets, since both operations commenced. These total shipments amount to 79.4 million tons of which approximately 57.5 million tons went to the United States, 12.8 million tons to Britain, 6.0 million tons to Western Europe and 3.1 million tons to domestic consumers. The total value of all these shipments is in the order of $950 million.

IOC is owned by a consortium of Canadian and United States companies, with the distribution of shares reported as follows:

Hollinger Consolidated Gold Mines, Limited	-	11.6%
Labrador Mining and Exploration Company Limited	-	5.4%
Hanna Mining Company	-	26.9%
Armco Steel Corporation	-	6.1%(est.)
Bethlehem Steel Corporation	-	17.4%(est.)
National Steel Corporation	-	16.4%(est.)
Republic Steel Corporation	-	5.1%
Wheeling Steel Corporation	-	5.1%(est.)
The Youngstown Sheet and Tube Company	-	6.0%(est.)

1/ Long tons of 2,240 pounds are used throughout this section.

TABLE 3-1

Estimated* Shipments of Direct-Shipping Ore from IOC's Schefferville Operations (Labrador Area) by Destination, 1954-1967

Year	Canada	United States			Britain	Western Europe	Total‡
		Great Lakes	Other Ports	U.S. Total			
	000 long tons						
1954	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	1,225.0#
1955	196.0	n.a.	n.a.	3,540.0	312.0	64.9	4,112.9
1956	281.7	n.a.	n.a.	3,379.0	588.0	156.4	4,405.0
1957	160.5	n.a.	n.a.	3,150.0	732.0	341.5	4,384.0
1958	162.5	n.a.	n.a.	2,000.0	500.0	198.0	2,860.5
1959	511.6	707.0	1,193.1	1,900.1	479.9	193.4	3,085.1
1960	201.5	1,169.4	1,309.3	2,478.7	928.3	329.6	3,938.1
1961	110.0	1,522.0	1,372.0	2,894.0	1,032.0	408.0	4,444.0
1962	97.4	2,020.0	1,819.0	3,839.0	794.0	360.0	5,090.4
1963	5.0	1,389.0	922.6	2,311.6	699.7	360.4	3,376.7
1964	10.8	1,605.0	1,304.0	2,909.0	438.0	65.0	3,422.8
1965	3.7	995.0	1,234.4	2,229.4	720.0	501.0	3,454.1
1966	-	1,003.1	1,460.3	2,463.4	588.9	280.0	3,332.2
1967	18.7	705.0	1,025.0	1,730.0	452.5	192.8	2,394.0
Total‡	1,759.3	11,115.5	11,639.7	34,824.1	8,265.3	3,451.0	49,524.8

* Calculated by prorating shipments on the basis of ore mined in the Québec and Labrador sections of the Schefferville area.

‡ Lines and columns may not add to totals due to rounding.

Mostly to the United States.

n.a. = Not available.

Source: Iron Ore Company of Canada.

TABLE 3-2

Shipments of Carol Concentrates and Pellets, by Destination, 1962-67

Year	Canada	United States: Great Lakes	United States: Other Ports	Britain	Western Europe	Total
	---------- 000 long tons ----------					
1962	65.6	356.7	307.6	1.2	8.5	739.6
1963	170.9	1,706.1	1,389.6	784.0	-	4,050.7
1964	252.5	2,782.7	1,796.4	1,374.2	286.1	6,491.8
1965	332.8	3,019.5	1,852.2	1,146.0	479.5	6,830.0
1966	223.3	1,982.6	2,280.1	453.5	274.8	5,214.3
1967	283.5	1,762.2	2,254.7	780.9	1,435.8	6,517.2
Total	1,328.5	11,609.9	9,880.6	4,539.8	2,484.7	29,843.6

Source: Iron Ore Company of Canada.

Carol Pellet Company, the company which was formed to pelletize the Carol concentrates, is owned by the following companies:

Hanna Mining Company	-	23.08%
Armco Steel Corporation	-	7.69% (est.)
Bethlehem Steel Corporation	-	38.47% (est.)
National Steel Corporation	-	7.69% (est.)
Republic Steel Corporation	-	7.69%
Wheeling Steel Corporation	-	7.69% (est.)
The Youngstown Sheet and Tube Company	-	7.69%

As mentioned previously most of IOC's ore shipments are to this consortium of companies - Hollinger Gold Mines Limited and Labrador Mining and Exploration Company Limited, of course, being the exceptions as they take no ore on their own accounts, although they are entitled to do so if they wish. Hanna Mining Company sells its share as merchant ore with most of it going to Bethlehem Steel Corporation. Ore that is not contracted for by the owner-companies is sold as "merchant ore" by The Hanna Mining Company.

Wabush Mines

Wabush Mines is operated as two divisions: Wabush Mines, Scully Mine at Wabush, Labrador; and Wabush Mines, Pointe Noire at Pointe Noire, Québec. The mine and concentrator are at

Wabush and the pellet plant, formerly referred to as Arnaud Pellets, is at Pointe Noire, Québec. As of January 1, 1967, the two German companies in the consortium, Hoesch A.G. and Mannesmann A.G., transferred their shares of ownership in Wabush Mines, Scully Mine, to the other original owners. This transfer was dictated by the fact that there was a change in the iron ore supplies and requirements of the two German firms. The two German companies never purchased pellets, only concentrates, and did not participate in Arnaud Pellets. Expansion of the pellet plant was to be completed early in 1968; the plant's new capacity will be 6 million tons annually. With the drop-out of the two German companies, all or nearly all the concentrates produced at Wabush will be pelletized.

Wabush Mines' participants are reported to be:

The Steel Company of Canada, Limited	-	25.6%
Dominion Foundries and Steel, Ltd.	-	16.4%
The Youngstown Sheet and Tube Company	-	15.6%
Interlake Steel Corporation	-	?
Pittsburgh Steel Company	-	10.2%
Inland Steel Company	-	10.0%
Pickands Mather & Co. (also Managing Agent)	-	5.2%
Societa Finanziara Siderurgica, Finsider Per Azioni (Finsider)	-	?

Since shipments began in 1965, Wabush Mines has shipped some 10.8 million long tons of concentrates and pellets. Of this, 4.9 million tons went to United States based owner-companies and 4.6 million tons to the two Canadian based owner-companies, 1.2 million tons to the European owner-companies, and 0.16 million tons to British steel producers.

Except for the small shipment of 161,094 tons to Britain in 1967, most of Wabush Mines' output has been purchased by owner-companies. The value of the company's shipments to the end of 1967 (based on an average price for concentrates, f.o.b. Wabush, of $8.50 a ton)1/ is $159.8 million.

1/ The price of $8.50 was arrived at by calculating the value per ton of exports of concentrates from D.B.S. statistics, and subtracting $1.80-a-ton rail costs from Wabush to Pointe Noire.

TABLE 3-3

Shipments of Concentrates and Pellets from Wabush Mines, 1965-67

Year	Canada	United States		Britain	Western Europe	Total*
		Great Lakes	Other Ports			
	------------------ 000 long tons ------------------					
1965	713.9	1,072.5	-	-	226.3	2,012.8
1966	1,599.7	1,669.8	-	-	568.7	3,838.2
1967	2,254.7	2,174.4	-	161.1	383.9	4,974.1
Total*	4,568.3	4,916.7	-	161.1	1,179.0	10,825.1

* Lines and columns may not add to totals due to rounding.

Source: Company Reports.

Island of Newfoundland

Dosco Industries Limited, Wabana Mines Division

Wabana Mines Division, Dosco Industries Limited, closed its Bell Island, Newfoundland, mine on June 30, 1966, after 75 years of continuous operation. Shipments from the Wabana mine reached a high of 2.81 million long tons[1/] in 1960 but had decreased to 1.2 million tons in 1965 and shipments amounting to 792,414 tons from production and stockpiles were made in 1966. Shipments from the mine between 1892 and the end of 1966 totalled almost 79.0 million tons of which 34.6 million tons were used in Canada and 44.4 million tons were exported, mainly to Germany, Britain, Belgium and Holland.

After the mine closed, several attempts were made to interest German and British steel producers in buying the remainder of the stockpile and in reopening the mine. However, all such attempts failed because the ore is of low quality by today's standards and it is expensive to mine. These factors and the cost of transportation to possible markets in Europe, the only market where the ore's high phosphorous content could be tolerated, priced Wabana's iron ore out of the market.

Extensive beneficiation tests have been made in an attempt to upgrade the ore, but without success as the cost

1/ Long tons of 2,240 pounds are used throughout this reference to Wabana.

factor again precluded the chances of successfully marketing the ore. Even if a successful procedure could be developed, there are many more, less expensive ore deposits to which the process could be applied.

Table 3-4 shows the mine's total shipments from 1892 through 1966 by destination. Canadian steel producers purchased some 44 per cent of the mine's total output, and most of that was purchased by the mine's parent company for use in the steelworks in Sydney, N.S. Canada, Germany, Britain, the United States and Belgium, were, in that order of importance, the customers for the mine's iron ore. The value of Wabana iron ore was $6.50 a long ton f.o.b. Wabana in 1961-62 and probably $5.00 a ton in 1966. There is no reason to expect an increase in its value even in the unlikely event that customers could be found.

TABLE 3-4

Shipments of Iron Ore from Wabana Mine, Newfoundland, by Destination, 1892-1966

Date	Canada	Germany	Britain	Belgium	France	U.S.	Holland	Italy	Total*
	000 long tons								
1892-1948	25,387.8	12,776.4	5,513.0	8.3	-	2,434.5	-	-	46,120.0
1949	738.6	-	711.3	-	-	30.7	-	-	1,480.5
1950	858.2	47.4	119.4	-	-	20.1	-	-	1,045.1
1951	666.4	150.2	713.5	-	-	19.5	-	-	1,549.7
1952	522.6	333.5	612.4	-	-	-	-	-	1,468.5
1953	759.3	501.5	1,139.0	-	-	-	-	-	2,399.8
1954	555.7	702.7	897.2	-	-	-	-	-	2,155.7
1955	451.4	977.0	957.6	-	-	21.0	62.2	-	2,469.1
1956	489.9	1,038.8	1,028.6	-	12.9	10.6	73.4	-	2,654.2
1957	587.5	1,013.0	1,016.0	47.8	13.0	10.5	73.9	20.2	2,781.8
1958	388.9	702.0	771.3	26.5	-	-	105.9	-	1,994.7
1959	402.3	572.1	868.2	81.8	-	7.7	144.3	19.0	2,095.3
1960	541.8	857.8	959.0	178.6	-	10.9	171.7	87.0	2,806.9
1961	298.4	747.6	604.0	412.0	-	5.5	143.2	81.6	2,292.4
1962	397.6	237.9	180.6	253.8	-	6.3	101.1	108.1	1,285.4
1963	562.5	11.9	322.3	176.7	-	-	45.1	49.1	1,167.6
1964	390.5	233.5	301.7	286.9	-	-	-	30.9	1,243.4
1965	149.9	292.5	171.0	536.7	-	-	36.6	-	1,186.7
1966	429.0	279.0	67.9	-	-	-	16.5	-	792.4
Total*	34,578.3	21,474.8	16,954.1	2,009.0	25.9	2,577.3	974.0	396.0	78,989.4

* Lines and columns may not add to totals due to rounding.

Source: Dosco Industries Limited.

Metallics Sector, Nonferrous Group and Byproducts

The nonferrous and byproduct metals produced in the Atlantic Provinces are zinc, copper, lead, gold, silver and cadmium. Copper is produced in the concentrate form only, but zinc and lead are produced both as refined metals and in concentrates. Gold, silver and cadmium are recovered from the base metals concentrates when they are processed. The principal markets for concentrates and refined metals are in the United States, Europe and Japan. These markets are readily accessible to the mines and plants in the Atlantic Provinces because of the proximity to ocean transportation.

Copper

Copper's properties of malleability, ductility, conductivity, corrosion resistance, alloying qualities and pleasing appearance make its use universal in the electrical, construction, plumbing and automotive industries. Approximately 35 per cent of the copper consumed goes into electrical equipment, 32 per cent into fabricated metal products, 13 per cent into non-electrical machinery, 13 per cent into transportation equipment and the remainder into miscellaneous products.

The sources of world mine production of copper are as follows:1/ North and South America 52 per cent, South and South-central Africa 22 per cent, Asia 5 per cent, Europe 3 per cent, Australia 2 per cent, and Soviet Sphere countries 16 per cent. The major consuming areas are North America 38 per cent, Europe 33 per cent, Japan 8 per cent, the Soviet Sphere countries 15 per cent and Other 6 per cent. Of the major producing countries, only the United States and Japan consume more copper than they produce. Over 57 per cent of the non-communist world production comes from the less-developed countries that use only 11 per cent of the total world consumption. Producing countries such as Canada and Australia must compete for their share of world markets against the less-developed countries. Canada consumes less than half its copper production and sells the remainder in world markets at prices over which the Canadian companies have no direct control.

There are no known deposits in the Atlantic Provinces with sufficient reserves or production to justify the installation of a copper smelter. The producing mines ship copper concentrates to domestic or foreign custom smelters for treatment and subsequent sale of the refined copper. Because of the proximity of the mines to ocean transportation, nearly all world markets are accessible. Copper in concentrates has been shipped from Newfoundland to smelters in Canada, the United States and Europe; from New Brunswick to smelters in Canada, Europe and Japan; and from Nova Scotia to U. S. smelters.

1/ Based on 1967 data.

World copper consumption has been increasing at an average annual rate of about 4.5 per cent a year. The rate of increase will vary from year to year but will probably average from 4.5 to 5 per cent a year for some time. There will be a ready market for copper concentrates in Canada, Europe and Japan. Prices and smelter contract terms will vary with the world demand situation, but in general should be favourable for the development of copper mines in the Atlantic area.

Gold

Gold production in the Atlantic Provinces is derived as a byproduct of base metal ores. In recent years no production has come from lode gold mines nor is any expected from this source. The gold is contained in the base metal concentrates that are sold.

Gold contained in a base metal orebody may influence the decision to bring a property into production. However, in the Atlantic Provinces, gold is not expected to have any significant influence on the mineral economy of the area.

Lead

In 1967 the world consumed approximately 3.3 million tons of lead in metal products, pigments, chemicals, and miscellaneous applications. The major uses are in storage batteries, tetraethyl fluid, paint pigments, industrial alloys, and construction materials. The physical and chemical factors affecting the uses of lead are softness, heaviness, resistance to corrosion, low-melting and high-boiling points, energy absorption and transmission qualities, low price and high recoverability (as scrap) and its antiknock effect on fuel combustion.

World mine production of lead comes from: 1/ North America 26 per cent, Europe 16 per cent, Australia 13 per cent, South America 8 per cent, Africa 6 per cent, Asia 3 per cent and Soviet Sphere countries 28 per cent. The distribution of smelter production is roughly comparable: North America 22 per cent, Europe 27 per cent, Australia 10 per cent, South America 4 per cent, Africa 4 per cent, Asia 6 per cent and Soviet Sphere countries 27 per cent. As in the case of zinc there is a tendency for smelter capacity to be concentrated in the highly industrialized areas of North America and Europe. The United States' smelter capacity, largest in the non-communist world, exceeds U.S. mine production by about 40 per cent. Smelter capacity in Europe exceeds mine output by some 41 per cent and in Japan by 39 per cent. This excess smelter capacity in the major consuming areas provides a ready market for lead concentrates but tends to restrict the opportunity to establish smelter facilities in mining areas elsewhere in the world.

1/ Based on 1967 data.

Consumption of lead is approximately equal in Europe (44 per cent of the non-communist world total) and North America (43 per cent). Consumption in Japan (5.7 per cent) has been rising and there is a possibility of an increased market demand for concentrates in this area.

The consumption of refined lead and lead in alloys differs in the consuming areas. In 1965, world consumption, and consumption by areas, was distributed among uses as follows:

	Use					
Area	Batteries	Cable Sheathing	Fuel Additives	Sheet & Pipes	Pigments	Other
	%	%	%	%	%	%
World	30.4	16.8	10.9	11.4	9.4	21.1
Europe	26	25.7	4.9	16.7	9.7	17
U.S.A.	36.1	4.8	19.1	4.1	8.7	27.2
Japan	25	28	?	19	12	16

United States consumption for batteries and fuel additives reflects the high per-capita ownership of automobiles. Consumption in these fields is increasing in Europe and Japan in line with the increase in the number of private vehicles. Cable sheathing and sheet and pipe consume a higher percentage of the total lead consumption in Europe and Japan than in North America. Among the "other" uses that contribute to the higher percentage of consumption in this category in the United States are bearing alloys, solder alloys and semifinished products.

Lead consumption in the non-communist world has been increasing since the start of the 20th century. The rate of increase has varied from year to year (in some instances there have been declines), and since 1962 has averaged 3 per cent a year. Consumption will continue to increase, particularly in the United States, Japan and Europe. Markets will be established in the developing countries, but the size and rate of growth of these markets is unpredictable.

The following comments apply to production and marketing of both lead and zinc from the Atlantic Provinces.

The principal lead- and zinc-producing districts in the Atlantic Provinces are at Bathurst, N.B., and Buchans, Newfoundland. These multi-metal deposits, four in New Brunswick and one in Newfoundland, are mined for zinc, lead, copper and silver, in that order of abundance. There is a single lead-zinc smelter in the Atlantic Provinces at Belledune, N.B., with capacity to smelt up to 45 per cent of the lead production and 25 per cent of the zinc production of the region. Marketing lead and zinc, therefore, is mainly a question of selling lead and zinc concentrates to custom smelters outside the Atlantic Provinces.

Lead and zinc concentrates have traditionally been sold to coastal smelters in continental Europe and Britain, which are well located to treat concentrates from overseas. In contrast, the Canadian and most of the U.S. smelters are inland, and are therefore better located to treat concentrates from central and western Canada than those from the eastern Canadian seaboard.

Concentrates from the Atlantic Provinces are sold chiefly in Belgium, and also in the Netherlands, Britain, France and West Germany, and to a smaller extent in the United States and Japan. Sales are made on the basis of long-term contracts so that both mines and smelters can plan their operations several years ahead. The price is based on the price of refined metal adjusted for smelting charges.

Since the start of production from the deposits in the northern part of the province, New Brunswick has come to be recognized as one of the major zinc-lead districts of the world, with large installed production capacity and adequate ore reserves, both developed and potential, for many years of large-scale operations. Such mines as these, and the Buchans mine in Newfoundland which, though not as large, may be considered also in this category, are preferred sources of supply for custom smelters in many parts of the world. Marketing mine products, therefore, is not likely to be a problem for the mine owners.

Refined lead and zinc are produced at Belledune, near Bathurst, N.B., by East Coast Smelting and Chemical Company Limited, controlled by Noranda Mines Limited. Its sales markets presumably follow the same pattern as those of other primary lead and zinc producers who sell metal all over the world. Marketing refined lead and zinc is highly competitive, but as previously noted, demand has grown steadily in the past and the outlook is for continuing growth in world consumption, which places operations such as the one at Belledune in a favourable position. It is possible that at some future time smelter capacity at Belledune may be expanded, but no plans for expansion have yet been announced.

Silver

Silver is an important and valuable byproduct of nonferrous mineral production in the Atlantic Provinces. In 1967 silver contributed 6.5 per cent of the value of nonferrous production from the region.

The largest usage of silver is in the minting of coins. Because of the increase in the price of silver since 1963 this use is decreasing. Silver's principal industrial applications are in the manufacture of photographic film, plates and papers, electrical contacts and components, silverware and jewelry, batteries, dental alloys, and mirrors. Industrial uses have

been increasing, owing largely to silver's properties of high conductivity and resistance to corrosion which have led to increasing use in electronic circuitry where reliability is a prime requirement.

Consumption of silver has been increasing more rapidly than mine production and as a result there has been a growing imbalance between new production and consumption. The difference has been made up by sales from United States Treasury stocks, demonetized coin, secondary recovery (scrap), and stocks sold by other governments.

A recent source of silver has arisen as a result of the conversion to other coinage materials by many countries including Canada, the United States, Australia and Belgium. Silver coins withdrawn from circulation are melted and refined to commercial-grade silver (99.9 per cent silver). A corollary to this is the hoarding of silver coins by collectors and speculators, resulting in a substantial reduction in the potential supply.

Production of new silver is relatively inflexible and therefore incapable of being increased to meet new demands. Most silver is produced as a byproduct of the treatment of base metal ores. In the United States two thirds of the new silver produced is derived from base metal ores, and in Canada more than 85 per cent is derived from lead, zinc and copper ores. Despite reductions in the use of silver for coinage, industrial uses will probably increase, and there is not likely to be a balance between new silver production and demand.

Prices were maintained at stable levels up to 1961 by the pricing and purchasing policies of the United States Treasury In 1961, the Treasury stopped the selling of silver held surplus to the amount required to back U.S. silver certificates. The price rose to the statutory level of $1.293 (U.S.) an ounce by 1963 and remained at this level until 1967, when further restrictions on sales from United States government stocks caused the price to rise as high as $2.17 (U.S.) an ounce. The high prices have brought about some substitution in the industrial uses of silver and have accelerated the trend to substitute other metals for coinage. The price has not yet reached a level that would effectively stimulate increased mine output.

Most of the silver produced in the Atlantic Provinces is derived from lead-zinc ores. Increased production of this type of ore, particularly from the Bathurst district of New Brunswick, will result in a rise in silver output. There should be a ready market for this material in Canada, the United States, Europe and Japan.

Zinc

The principal uses of zinc are in galvanizing, die casting alloys, copper alloys (brass), rolled zinc and zinc oxide. In galvanizing, zinc is applied as an impervious, corrosion-resistant coating to iron and steel products to prevent rust. Galvanized sheet is used in industrial, agricultural and residential construction, in highway construction for guardrails, culverts and signs, and in automobile construction for the prevention of rust on underbody sections. Galvanized wire is a common fencing material. Galvanized tube is used for railings, fence posts, scaffolding and as water pipe. Many hundreds of steel items, from small hardware items to large structural shapes, are commonly galvanized after fabrication to reduce maintenance costs.

About 90 pounds of zinc per car is used in the automotive industry in the form of zinc die castings made from zinc-base alloys. Parts commonly die-cast include grilles, headlight and taillight assemblies, door and window hardware, carburettors and fuel pumps. Zinc-base die castings are also used as components in household appliances such as washing machines and refrigerators, in outboard motors, plumbing and hardware supplies.

Brass, a copper-zinc alloy containing as much as 40 per cent zinc, has many applications in the form of sheets, strips, tubes, rods and wire, castings, and extruded shapes.

In North America, rolled zinc is mainly used for making dry-cell batteries in which zinc serves both as the negative pole of the cell and as the container. In Europe, rolled zinc is a popular roofing and roof-flashing material. Other uses of rolled zinc include terrazzo strip and anticorrosion plates for boilers, dock pilings and ships' hulls.

Zinc oxide is used in compounding rubber and in making paint, rayon yarn, ceramic materials, inks, matches and many other commodities.

The foregoing brief description of zinc uses indicates that the rate of consumption of zinc depends to a great extent on the rate of industrial activity, particularly in the steel, automotive and durable goods industries. Zinc consumption in the non-communist world has grown since 1960 at an average rate of 4.5 per cent a year, rising from 2.7 million tons to 3.6 million tons in the seven-year period. There will be overcapacity in the period from 1968 to 1970 but consumption should continue to rise at 4 per cent a year and, assuming no major industrial recession, a reasonably balanced supply-demand situation is foreseen for the period to 1980. The major consuming regions in the non-communist world are the United States 42 per cent, Europe 37 per cent, Asia 16 per cent, Australia 3 per cent and Other 2 per cent.[1/]

1/ Based on 1967 data.

Zinc production 1/ in the non-communist world must be considered on a dual basis - mine production and metal production. Canada, producing 30 per cent, is the world's largest mine producer of zinc, followed by United States 13 per cent, Peru 9 per cent, Australia 8 per cent, Japan 7 per cent, Mexico 6 per cent, and other countries 27 per cent. By regions, mine production is as follows: North America 50 per cent, South America 10 per cent, Europe 16 per cent, Asia 8 per cent, Africa 8 per cent and Australia 8 per cent. Metal production in the non-communist world is as follows: United States 28 per cent, Japan 16 per cent, Canada 11 per cent, Belgium 7 per cent, Australia 6 per cent, France 6 per cent, and other countries 26 per cent. By regions, metal production is distributed as follows: North America 42 per cent, Europe 30 per cent, Japan 16 per cent, Australia 6 per cent, and other regions 6 per cent.

The comments, in a previous section, on the production and marketing of lead in the Atlantic Provinces, are also applicable to zinc.

Nonmetallics Sector, Industrial Minerals Group

Asbestos

Asbestos is a high-value nonmetallic mineral with a diverse range of grades and, as an essential raw material in industry, has widespread international trade. The Atlantic Provinces' sole producer of asbestos, Advocate Mines Limited, is in Newfoundland; production in 1967 was 16.7 per cent of the total value of industrial minerals output in the Atlantic Provinces, second only to the value of sand and gravel. Shipments of fibre are made directly from modern terminal facilities at tidewater to markets in Europe, Australia, Canada and the United States. Markets for asbestos and its export from Newfoundland are unaffected by economic conditions in the Atlantic Provinces.

The Advocate mine and mill are managed by Canadian Johns-Manville Company, the largest asbestos producer and consumer in the world, excluding the U.S.S.R.; this company also holds the largest financial interest in Advocate. Other major interests are held by The Patino Mining Corporation, Amet Corporation Inc., and Financière Belge de l'Asbeste-Ciment, S.A. Through these corporate organizations, Advocate has access to international markets.

Advocate's main product is a grade of milled fibre suitable for the asbestos cement industry; current demand for this grade is good and is expected to remain so, especially in the developing countries of the world.

1/ Based on 1967 data.

Barite

Almost the entire output of barite from a single mine in Nova Scotia is exported to the United States. The barite is hauled by truck a distance of two miles to Walton Harbour for shipment in ocean-going vessels, in bulk lump form. Grinding and classifying is done in plants of the parent company, Dresser Industries, Inc., in the southern United States. Minor amounts, processed and bagged in Nova Scotia, are exported to Trinidad and Venezuela. Intermittently, small amounts of milled barite are sold in central Canada. In 1967, barite production, valued at $1.5 million, was 2.5 per cent of the total value of industrial mineral output in the Atlantic Provinces.

The parent company has a comprehensive research and sales organization geared to supply the needs of the oil and gas well drilling industry, which consumes about 75 per cent of all barite production. Affiliation with such an organization is an asset in the long-term prospects for the barite mine.

Fluorspar

Canada's only fluorspar mines, located on the Burin Peninsula, Newfoundland, are operated by Newfoundland Fluorspar Limited, a wholly-owned subsidiary of the Aluminum Company of Canada Limited. One of the two mines has been in operation since 1933 and the other was brought into production in August 1968. Almost all the fluorspar production, valued at $2.1 million in 1967, is shipped to ALCAN's metallurgical works at Arvida, Québec, where the concentrates are used in the manufacture of artificial cryolite, which is required for the reduction of alumina to aluminum. Minor tonnages of high-grade fluorspar are marketed for chemical manufacture.

Approximately 45 per cent of Canada's fluorspar requirements is imported, largely from Mexico.

Gypsum

Approximately 75 per cent of Canada's gypsum production is mined in the Atlantic Provinces, the bulk of it in Nova Scotia. New Brunswick and Newfoundland each have one gypsum mine. The combined Atlantic Provinces' gypsum output, valued at $8.3 million in 1967 and comprising 13.5 per cent of the total industrial minerals output of the four provinces, was produced by seven companies, one being Canadian and the remainder controlled by four U.S. companies. Apart from a small wallboard plant in Newfoundland, the entire structure of the gypsum industry is one of captive deposits and quarries supplying manufacturing operations in Canada and the United States.

Local markets for gypsum include: a wallboard plant in New Brunswick that takes all the output from a single quarry in the province; a wallboard plant in Newfoundland that takes part of the production from a single quarry in the province; a plaster plant in Nova Scotia that consumes a negligible amount of the output from the province's seven quarries; two wallboard plants in Montreal, Québec, that are supplied by shipments of gypsum from Nova Scotia. Most gypsum is exported in crude lump form to the eastern United States where it is used for gypsum products manufacture in building construction. Although the United States has abundant gypsum resources, they are located mainly in the western states; consequently gypsum from the Atlantic Provinces has a considerable freight advantage in supplying the highly populated areas of the eastern United States.

The value of producer shipments of gypsum from Nova Scotia, destined almost wholly for export, averaged $1.90 a ton in 1967; this was much lower than the range of $2.50 to $3.00 a ton for gypsum produced in other provinces. The main features of the industry are low production costs in highly-efficient quarry operations from near-surface deposits located close to tidewater, low-cost seaborne freight to the eastern United States and the vertically integrated structure of the companies. There is little opportunity for export of finished gypsum products from the Atlantic Provinces because of the relatively high shipping and handling costs. Gypsum products imported into the United States are subject to a 12.5-per-cent ad valorem tariff. Over-all, the gypsum industry will continue to be dependent upon export markets for its well-being and, consequently, the rate of growth will depend on parent company demands in the United States.

Peat Moss

Nearly all peat moss production in the Atlantic Provinces, mainly from bogs in northeastern New Brunswick, is packaged and shipped by rail to the urban and market gardening areas of the eastern United States. Small quantities are sold in the Atlantic Provinces and the rest of Canada. In 1966, the Atlantic Provinces produced 27 per cent of Canada's total peat moss output of 285,000 tons, of which over 93 per cent was exported to the United States. Taken as a whole, Canada supplied 91 per cent of United States total peat moss imports in 1966, an amount equivalent to about 27 per cent of the entire United States peat moss market.

There are no established standards for differentiating peat products for marketing purposes. Most packaging and selling is by the cubic foot or yard, the price being indicative of the size of container, the texture of the peat moss (described by terms such as "turfy", "fibrous", and "pitchy") and the degree of processing. For import purposes, peat moss enters the United States either as fertilizer grade or as poultry and stable grade.

New Brunswick's peat moss is a high-quality fertilizer grade for which there is duty-free entry into the United States.

At least two, and possibly four, of the Atlantic Provinces' 10 peat moss producers have, or are associated with, peat operations elsewhere in Canada and/or the United States.

Pyrophyllite

Canada's only pyrophyllite mine, located near Long Pond in the Conception Bay area of Newfoundland, is operated by Newfoundland Minerals Limited, a wholly-owned subsidiary of American Olean Tile Company, Inc., of Lansdale, Pennsylvania. Production in 1967 was valued at $450,000, all of which was shipped in bulk to the parent firm's plants in Lansdale, Pennsylvania, and Jackson, Mississippi. Production is utilized in the manufacture of ceramic tiles. Output depends solely on demand of American Olean's ceramic tile products. Should the need arise, production can be doubled to 60,000 tons of pyrophyllite a year with the existing facilities.

Quartz

The only quartz production in the Atlantic Provinces in 1967 was in Nova Scotia. Part of the total quartz output, which was valued at $48,000 in 1967, was a fine, high-grade, angular silica sand produced by Nova Scotia Sand and Gravel Ltd. during the washing and screening of sands for concrete aggregate. This fine angular sand is suitable for abrasive and sand blasting purposes and is marketed throughout the Atlantic Provinces.

Maritime Cement Company Limited, a subsidiary of the Canada Cement Company, Limited, produces small quantities of silica sand near Truro, for use in its Brookfield cement plant.

Salt

About three quarters of the Atlantic Provinces' salt production, all of which comes from two mines in Nova Scotia, is marketed in eastern Canada. Most of the remaining quarter is exported to the northeastern United States. A greater part of the shipments to the United States is carried by ocean-going vessels to markets along the Atlantic seaboard. In 1967, 471,000 tons of salt, representing 8.9 per cent of Canada's total salt output, were produced in Nova Scotia.

The domestic market for salt from the Atlantic Provinces, estimated at 325,000 to 350,000 tons in 1967, was split about equally among Nova Scotia, New Brunswick, and Québec, with lesser quantities for Prince Edward Island and Newfoundland. Highway and street ice- and snow-control provides the largest

single market, followed by the fishing and meat packing industries, industrial chemicals, and pulp and paper mills.

The two salt mines in Nova Scotia are controlled by Canada's two largest salt producers, The Canadian Salt Company Limited and Domtar Chemicals Limited. The former is controlled by Morton Salt Co. of Chicago, Illinois. Although salt is marketed in at least 100 different forms, grades and/or containers, most of it is sold in bulk, a large part of this being coarse-grained. The value of Nova Scotia's salt output in 1967 averaged $8.82 a ton.

Prior to January 1, 1968, bulk salt entering the United States was subject to a tariff of 1.7¢ per 100 lbs. As a result of the Kennedy Round Tariff Negotiations under GATT, this rate will be reduced to 0.8¢ per 100 lbs. by January 1, 1972.

Sulphur

Elemental sulphur is produced from imported crude oils at two refineries, one each in Nova Scotia and New Brunswick, and sulphuric acid is produced from smelter gases at Belledune, New Brunswick. The sulphuric acid plant is operated by Belledune Acid Limited, a wholly-owned subsidiary of Brunswick Mining and Smelting Corporation Limited. Raw feed in the form of sulphur dioxide gas is supplied from Brunswick Mining and Smelting's nearby lead-zinc smelter. Most of the sulphuric acid is used at an adjacent fertilizer plant operated by Belledune Fertilizer Limited (BFL), owned jointly by Brunswick Mining and Smelting and the Electric Reduction Company of Canada Limited (ERCO). The latter is a subsidiary of Albright & Wilson Ltd. of London, England. Through ERCO's sale organization, BFL sells ammonium phosphate fertilizers in North American and world markets. Capacity of the Belledune acid plant is estimated at 80,000 tons of contained sulphur yearly.

Elemental sulphur is recovered at Imperial Oil Enterprises Limited's Dartmouth refinery and Irving Refinery Limited's refinery in Saint John, New Brunswick. Because the sulphur is recovered from imported crude oil, production is not recorded in Canadian statistics. Combined sulphur output from the two refineries is estimated at 21,000 tons annually. The sulphur is sold in local markets, much of it to the pulp and paper industry.

Nonmetallics Sector, Structural Materials Group

For the most part, structural materials cannot be shipped economically for long distances so the prospective producer makes every effort to locate his quarrying or pit operation and plant in order to serve a regional market. In the Atlantic Provinces, which are generally well endowed with large deposits and

reserves of sand, gravel, clay, shale and exposures of limestone, as well as sandstone and granitic rocks suitable for most types of construction, the extent of production is a problem more of establishing markets than of finding a good raw material source.

In terms of both tonnage and dollar value, sand and gravel production represents by far the largest part of the Atlantic Provinces' industrial mineral output. In the absence of good sand and gravel deposits, substantial quantities of stone are used locally for concrete aggregate, road and dam construction. The demand for, and production of, all structural materials is naturally affected by the levels of housing, industrial, and road construction, and especially by large projects such as the proposed Northumberland Strait Crossing and the Churchill Falls hydro-electric power development.

Most of the structural materials output in the Atlantic Provinces is consumed within a 10- to 20-mile radius of its point of production. Apart from occasional shipments of cement and of building, monumental and ornamental stone, very little of the Atlantic Provinces' structural materials output is marketed beyond the perimeters of the four provinces.

Cement

There are three cement plants within the Atlantic Provinces, one each in New Brunswick, Nova Scotia, and Newfoundland, with a total production capacity of 770,000 tons of cement a year. Combined output in 1967 amounted to 414,330 tons representing 14.9 per cent of the total value of industrial mineral output of the Atlantic Provinces. Almost the entire output is marketed within the Atlantic Provinces.

The two largest plants, both on the mainland, are controlled by Canada Cement Company, Limited, the largest cement producer in Canada. The Newfoundland plant is the sole facility of North Star Cement Ltd., a small independent producer established by the Newfoundland government.

Cement production in the Atlantic Provinces is closely related to construction levels in residential, commercial, and industrial sectors, and in general urban development; demand for cement for these purposes is expected to increase modestly. In addition, there are large regional construction projects proceeding or proposed for future development that will require large tonnages of cement. They include the proposed construction of the Northumberland Strait Crossing between New Brunswick and Prince Edward Island, Churchill Falls hydro-electric development in Labrador, and other power development projects. Cement plants in the Atlantic Provinces have ample capacity to meet demands for cement in that area during the next few years.

Clay and Clay Products

Clay and clay-products production is closely related to regional markets and general trends in housing, commercial and industrial construction. Combined production of clay and clay products within the Atlantic Provinces in 1967 formed 3.6 per cent of their total industrial mineral output.

The largest volume of production is composed of structural clay products such as brick, tile and pipe. This segment of the industry is largely controlled by a Maritime-based company, which owns pits and plants in New Brunswick, Nova Scotia and Newfoundland. There is one small producer with a single plant in Nova Scotia. Altogether, seven clay and shale pits supply five brick and tile manufacturing plants located throughout the Atlantic Provinces, excluding Prince Edward Island. Almost all production is marketed in the areas surrounding the various plants.

Small amounts of fireclay are produced in Nova Scotia for use in the local steel industry.

Lime

Snowflake Lime, Limited, produces quicklime and hydrated lime in conjunction with its limestone operations near Saint John, New Brunswick; it is the Atlantic Provinces' sole producer of lime. The lime, valued at $79,000 in 1967, is marketed throughout the Atlantic Provinces for use in the construction, chemical and metallurgical industries.

Sand and Gravel

Sand and gravel production in the Atlantic Provinces in 1967 was valued at $16 million and constituted nearly 26 per cent of the total value of industrial mineral output, and about 4 per cent of the total value of all mineral production in the four provinces. Numerous sand and gravel producers are located throughout the Atlantic Provinces and operate to meet local market requirements, principally for road construction and other large-scale engineering projects. Adequate reserves are present in most areas of the Atlantic Provinces and, where sand and gravel are lacking or sparse, crushed stone is used. Because of low unit value, sand and gravel cannot be economically transported over long distances.

Stone

Although there is a wide variety of stone production, both by type and for end-uses, in the Atlantic Provinces, most of it is crushed limestone and dolomite for use as road metal.

By far the largest part of this material has been produced and consumed in New Brunswick, the centres of operation varying from year to year depending largely upon the location of the province's road-building programs. Large quantities of crushed stone and rubble and riprap are being used to build a breakwater at Belledune Harbour and will be required for the proposed Northumberland Strait Crossing and for the construction programs around the Churchill Falls hydro-electric power project.

Substantial quantities of agricultural, metallurgical, and chemical limestone are produced in the Atlantic Provinces, particularly in Nova Scotia and New Brunswick. Maritime soils are quite acidic and consequently require the application of basic soil conditioners. There are about eight limestone producers in Nova Scotia and New Brunswick that supply this market, which had an estimated value of $700,000 in 1967. Most of the metallurgical-grade limestone is produced on Cape Breton Island for use as flux in the iron and steel furnaces at Sydney. Most of the chemical-grade limestone is produced in Newfoundland and consumed in local pulp and paper mills for the manufacture of sulphite pulp. Some chemical-grade limestone is produced in Nova Scotia and New Brunswick, mainly for use in local pulp and paper mills. Each year about 60 tons of chemical-grade limestone is shipped from a quarry in New Brunswick for use in sugar refining.

Although the Atlantic Provinces have almost every type of rock that is used for building, monumental, and ornamental purposes, production is generally confined to granite and sandstone quarries in New Brunswick and Nova Scotia. Demand for, and production of, these types of stone from the various quarries fluctuates from year to year. There is an occasional export demand, but sales are largely confined to the Atlantic Provinces.

Mineral Fuels Sector

Coal

New Brunswick

The only coal mined in New Brunswick at present comes from the Minto coalfield in the Grand Lake district. Coal disposition from mines in this area in 1967 is shown in Table 3-5.

In 1967, 746,000 tons or about 89 per cent of New Brunswick coal production was consumed within the province. The chief user and mainstay of the New Brunswick coal market is the New Brunswick Electric Power Commission (NBEPC) which has four coal-fired thermal power plants. Coal used for industrial and institutional purposes within the province was 453,171 tons, or 54 per cent of total production. Pulp and paper plants were the largest individual industrial consumer. The only coal ship-

TABLE 3-5

Disposition of Coal from Minto Coalfield, 1967

Disposition	Quantity	Per Cent
	short tons	%
Used principally for industrial and institutional purposes within the province	453,171	54.08
New Brunswick Electric Power Commision	283,570	33.84
Shipped to Québec	91,363	10.90
Canadian National Railways	6,752	0.81
Domestic Consumption by Mine Employees	1,554	0.19
Used by Mine Railroads and Colliery Boilers	1,482	0.18
Canadian Pacific Railways	71	..
Total	837,963	100.00

Source: Department of Natural Resources, New Brunswick.

ped outside the province goes to Québec pulp and paper companies. In 1967 this amounted to 91,363 tons.

Coal production in New Brunswick has declined from 1,003,362 tons in 1964 to 837,963 tons in 1967. During this period there was a proportional decline in all New Brunswick's coal markets. Significantly, NBEPC, which has the greatest potential of utilizing the local coal, decided after careful study to use oil for its future thermal generating plants. Higher capital costs of coal-fired plants together with low coal reserves were reasons given for the trend to oil-fired plants. Also, the first three of six units of the new 600,000 kw Mactaquac hydro-electric power plant were completed in 1968 and will contribute to the lessening dependence on coal by NBEPC.

Three characteristics of New Brunswick coal that influence the present and future markets are poor quality, narrow thickness of the seams and small recoverable reserves. Coal marketing has required federal coal subventions that in 1967-68 amounted to $2,471,705, or $3.42 per ton. Out of a total production of 822,206 tons, subventions were paid on 722,381 tons, or 88 per cent. Coal mining dominates the Grand Lake area and employs about 30 per cent (in 1961) of the area's labour force.

A federal-provincial agreement to assist in resolving the problems of the Minto coalfield area was completed in March 1968. Under the agreement, federal subventions will be replaced by five annual payments to the province (total value $19.6 million). The province will assume financial and administra-

tive responsibility and other assistance needed by the industry. Implementation by the province of an over-all management program for the mines is a realistic solution to the problems created by the increasing inability of New Brunswick coal to compete with alternative energy sources.

Eventually the coal industry will be phased out completely. Sharp declines in total production will occur in late 1968 with the closing of the Miramichi Coal Company mine which has had an annual production of about 200,000 tons, representing about 20 to 25 per cent of New Brunswick's total output. If the present coal producers continue to operate, as they have in the past, then such uneconomic operations will reach the phase-out point shortly. However, if the operators can institute a collective arrangement whereby coal can be more economically recovered, then the industry may be capable of supplying coal for established local markets.

Nova Scotia

Total production of Nova Scotia coal in 1967 was 3,739,000 tons of which 1,441,000 tons, or about 39 per cent, was consumed within the province. The remaining coal production was sold to consumers in Ontario, Québec and the Atlantic Provinces, with a small amount going to the Island of St. Pierre. During 1967, coal-fired thermal generating stations consumed 884,000 tons in Nova Scotia, representing about 60 per cent of local consumption. The next largest consumer in the province was the Sydney steel plant, which used 113,000 tons for coke-making and 26,000 tons for boiler use. Other provincial consumers include small industrial complexes and a wide range of customers utilizing coal for domestic and commercial heating.

Ontario received 48 per cent and Québec 41 per cent of coal shipped to other provinces in 1967. Ontario Hydro was Nova Scotia's largest single customer, taking 789,000 tons of the 1,052,000 tons shipped to Ontario in 1967. The principal Québec markets for Nova Scotia coal were pulp and paper mills, cement plants and smelters.

As noted in Chapter 2, the Crown-owned Cape Breton Development Corporation is now the largest coal producer in Nova Scotia. The outlook for Nova Scotia coal will depend on the success which DEVCO has in rationalizing the industry. In any event, the future of Nova Scotia's coal industry is one of contraction to a size which can economically serve a local market made up of a few industrial customers and a declining residential and commercial heating sector.

Natural Gas

Moncton, New Brunswick, is the sole community in the Atlantic Provinces served by natural gas. The source of supply is the Stoney Creek field located just south of the city, a field which also provides the region's only oil production. The field is operated by New Brunswick Oilfields Limited, a subsidiary of Western Decalta Petroleum Limited. Moncton Utility Gas Limited is the gas distributor in Moncton. Total production in 1967 amounted to 103,311 Mcf. Although a pressure-maintenance scheme was instituted in 1965, production is expected to decline steadily.

The outlook for further gas discoveries in New Brunswick is similar to that for oil in that it is unfavourable onshore. However, there are interesting possibilities yet to be tested offshore. If large reserves of natural gas are found offshore there is a ready market, not only in New Brunswick, but also in Nova Scotia, Prince Edward Island and much of eastern Québec. These areas are not served by western Canadian gas which is transported through the system of Trans-Canada Pipe Lines Limited as far east as Tracy, Québec. The additional cost involved in extending this pipeline to the Maritimes is not economically attractive, particularly since pipeline gas cannot compete with imported oil. An indigenous source of natural gas would not be confronted with extra-long-distance transportation problems and would be a very marketable commodity.

Petroleum

The only productive oil area in the Atlantic Provinces is the small Stoney Creek field located nine miles south of Moncton, New Brunswick. In 1967, total production amounted to 8,837 barrels, which is an average of 24 barrels of oil a day. This field, which was essentially developed as a gas field, has been producing for 58 years; during this time the total volume of oil extracted amounts to less than one day's present Canadian production. New Brunswick Oilfields Limited, now owned by Western Decalta Petroleum Limited, operates the field. The production is stored until sufficient quantities have accumulated to permit shipment by rail to Imperial Oil's refineries at Dartmouth, Nova Scotia. Oil production from this field is unlikely to be significantly increased in the future, so this marketing pattern will probably remain unchanged until the field is depleted.

Hudson Bay Oil and Gas Company completed a number of wells in the Bay of Chaleur region in 1967, but all were dry. It is most unlikely that any large oil fields will be discovered in New Brunswick, although small accumulations may be found.

Although the outlook for further onshore oil discoveries in the four Atlantic Provinces is not optimistic, offshore

areas such as the Gulf of St. Lawrence, the Atlantic shelf and the Grand Banks offer much more favourable prospects for future oil and gas development. If major oil reserves are found here, traditional marketing patterns in the Atlantic Provinces, and also Québec, would probably be changed. Refineries in the Atlantic Provinces depend on tanker-borne imported crude oil for their feedstocks. In Québec, the refineries are all located in an area immediately east of Montreal where they receive imported crude oil either by overland pipeline from the tidewater terminal at Portland, Maine, or directly by tanker during the St. Lawrence River shipping season. These refinery centres would offer the most favourable prospects for marketing any offshore production that may develop, provided it is reasonably competitive in price with foreign oil. Plants in this market region could absorb volumes approaching a half-million barrels daily.

4. MINING INDUSTRY FORECAST, 1968-1977

Regional Summary

This chapter presents a 10-year forecast of output, employment, and investment in the Atlantic Provinces mining industry to 1977. All monetary values are in constant 1966 dollars. The statistical basis of the forecast is primarily the mining-industry approach rather than the mineral-commodity approach. 1/ The mining-industry approach is compatible with the statistical approach used for other economic sectors.

The forecast indicates that economic activity in the Atlantic Provinces' mining industry will most probably increase moderately as follows:

	1964 (actual)	1968	1977
Value of Production 2/ (million 1966 $)	256	356	449
Value Added (million 1966 $)	168	233	287
Employment	14,510	16,420	15,690

The decline in over-all employment reflects the expected rationalization of the labour-intensive coal mining industry. Investment totalling $700 million is expected to be placed in the Atlantic Provinces' mining industry during the forecast period. Trends in provincial and industry components of the mining industry are shown in Figures 4-1 and 4-2.

The trends, as depicted in Figures 4-1 and 4-2, reflect the following expected developments in the Atlantic Provinces' mining industry during the period 1968-1977:

1/ For an explanation of the distinction between the mining-industry and mineral-commodity approaches, as well as a statistical explanation of the forecast method, *see* Appendix A.

2/ Value of production on the mineral-commodity basis is expected to increase from $458 million in 1968 to $582 million in 1977 (compared with $436 million in 1967).

FIGURE 4-1

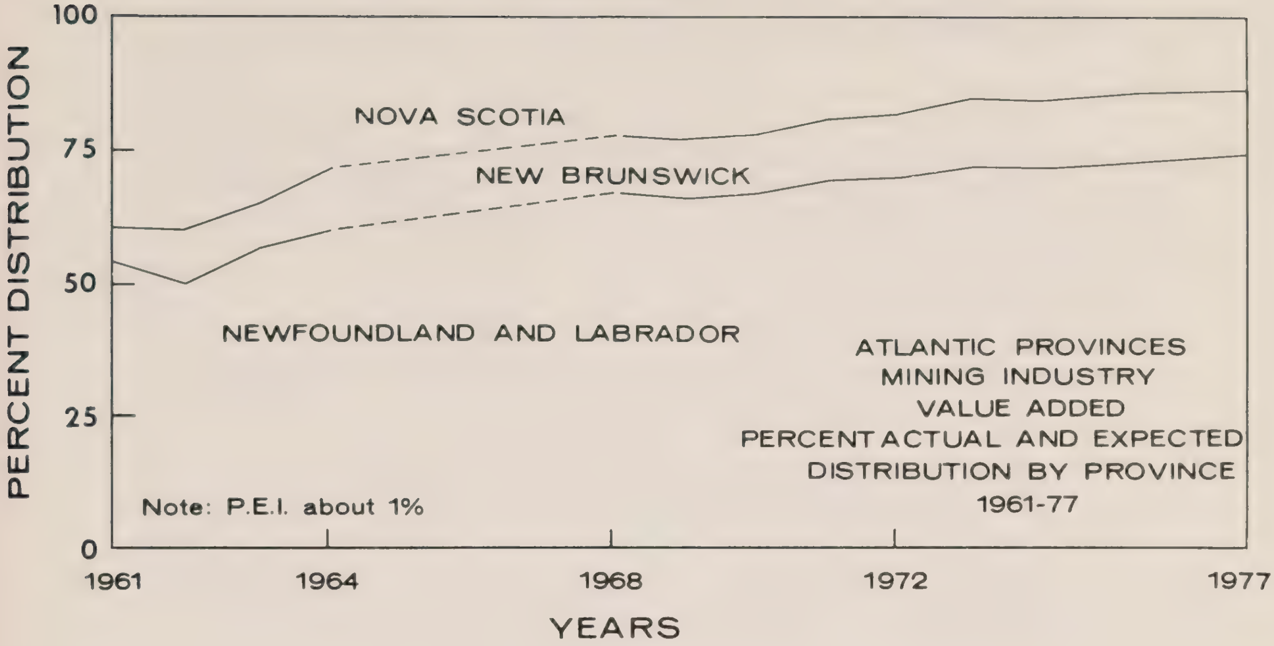
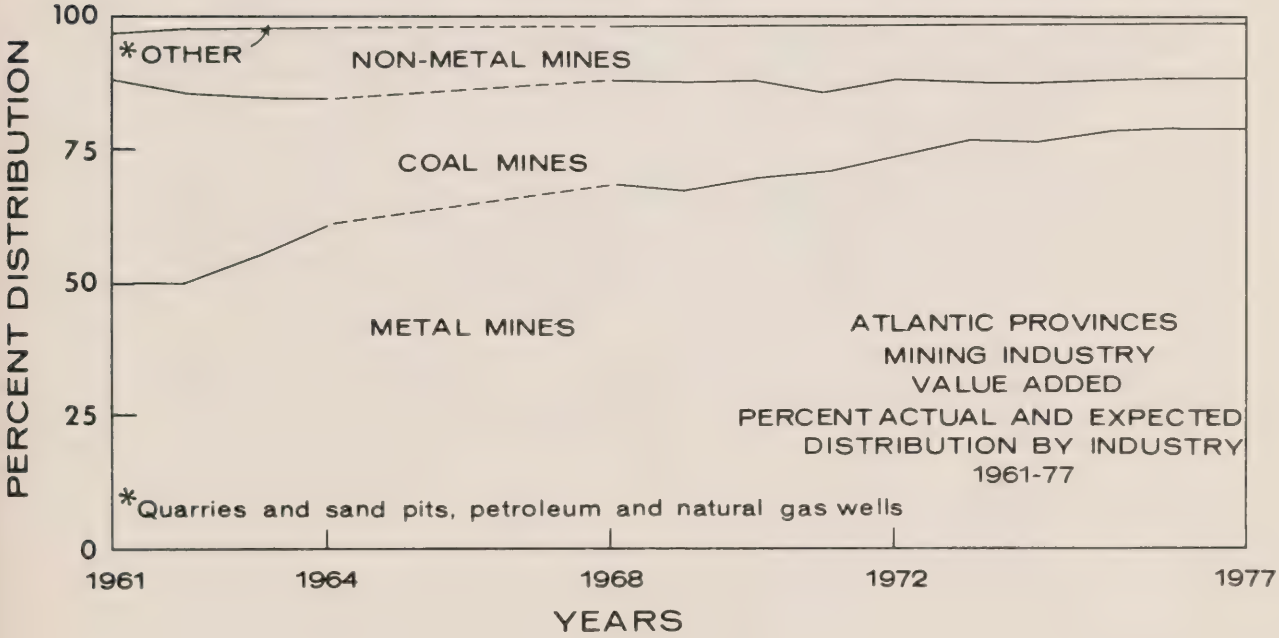


FIGURE 4-2



1) Important growth is expected in the Newfoundland and Labrador iron ore mining industry resulting from increased beneficiation of iron ore within the province, a partial shift from the mining of direct-shipping type ore to lower grade material amenable to concentration, and a moderate growth in demand for the iron product.

2) Productive activity for Newfoundland and Labrador's nonferrous metal mining industry is expected to be maintained at current levels through the forecast period, with discovery and development of new deposits balancing the exhaustion of currently producing mines.

3) Newfoundland and Labrador's nonmetallic mining industry is expected to grow modestly during the period with expansion in fluorspar, pyrophyllite and gypsum mining activities.

4) Important growth is expected during the forecast period in the New Brunswick metal mining industry resulting from the expansion of current operations, the development to production of known deposits of economic potential, and some new discoveries and development toward the end of the period.

5) In the New Brunswick coal mining industry, the expected rationalization of the Minto coalfield would result in a decline in coal mining output of over 50 per cent during the period (it could be considerably more).

6) The expected rationalization of the Nova Scotia coal mining industry, reflecting the program approved by the Governments of Canada and Nova Scotia, would result in a decline in coal mining output of almost 40 per cent over the forecast period.

7) Modest growth is expected in Nova Scotia's nonmetallic mining industry during the period, primarily in salt and gypsum mining activities.

8) Although there is considered to be petroleum and natural gas potential in offshore areas adjacent to the Atlantic Provinces, its realization in terms of productive activity is assumed to lie beyond the forecast period. Should a significant oil or gas discovery be made within the next four or five years, forecast estimates of output, employment and investment would have to be revised.

9) Primary petroleum and natural gas potential, coupled with metallic mineral resource potential, is expec-

ted to stimulate mineral exploration activity and investment in the Atlantic Provinces during the forecast period.

10) Productive activity in the Atlantic Provinces' quarries and sand pits industry is expected to increase modestly during the period in phase with regional construction activity.

The most-probable estimates outlined above must be considered in relation to the uncertainties involved. These uncertainties are accounted for in the forecast. For each of the four measures of economic activity (value of production, value added, employment and investment) three trends were estimated:

1) most-probable trend - what is most likely or expected;

2) least-possible trend - a lower confidence limit reflecting the realization of very pessimistic conditions for the industry;

3) most-possible trend - an upper confidence limit reflecting the realization of very optimistic conditions for the industry.

These upper and lower confidence limits, expressions of qualitative and semi-quantitative judgments, are summarized below.

		1977		
	1964 (actual)	Least Possible	Most-Probable	Most Possible
Value of Production (million 1966 $)	256	280	449	720
Value Added (million 1966 $)	168	180	287	460
Employment	14,510	8,300	15,690	25,800
Cumulative Investment 1968-1977 (million 1966 $)	-	420	701	1,310

These wide confidence limits reflect uncertainties with respect to product markets, exploration results, and pro-

cessing technology, that necessarily attend a regional forecast looking 10 years into the future.

Newfoundland and Labrador Forecast

The forecast indicates that economic activity in Newfoundland and Labrador's mining industry will most probably increase moderately as follows:

	1964 (actual)	1968	1977
Value of Production 1/ (million 1966 $)	156	239	327
Value Added (million 1966 $)	101	154	212
Employment	4,993	6,200	8,200

Investment totalling $550 million is expected to be placed in the Newfoundland mining industry during the forecast period.

Metal Mining

The most important forecast component is the iron ore mining industry. The growth in iron ore mining activities in Labrador during the mid-1960's has been spectacular. In the six-year period 1962-67, value of production increased about two-and-one-half times. A significant levelling off from this rate of growth is expected during the forecast period. Nevertheless, important increases are expected during the period in both the quantity of iron ore mined and the degree of beneficiation taking place within the province. Iron ore mining currently accounts for about 80 per cent of the value of production of the Newfoundland and Labrador mining industry and this share is expected to increase to 84 per cent by 1977. This expected growth will result from increased beneficiation of iron ore within the province, a partial shift from the mining of direct-shipping type ore to lower grade material amenable to concentration, and a moderate growth in demand for the iron product. It should be noted that the employment estimates reflect increases in iron ore productivity that have attended the installation of larger-scale plants in the period 1962-67.

1/ Value of production on the mineral-commodity basis is expected to increase from $282 million in 1968 to $388 million in 1977 (compared with $265 million in 1967).

The least-possible trend for the iron mining industry assumes growth during the first half of the forecast period on the basis of present expansion programs with output being maintained at this capacity through the second half of the period. The most-possible trend assumes a growth rate comparable to that realized in the Newfoundland iron ore mining industry during the past decade.

Productive activity for the remainder of the Newfoundland and Labrador metal mining industry is expected to be maintained at 1967 levels through the forecast period. The depletion of two currently producing base metals mines is expected. However, this should be balanced by the discovery and development to production of several new deposits, a result of the vigorous base metals exploration programs currently being pursued in the province by a number of large and experienced mining firms. New base metals discoveries are expected to conform to past results, i.e., narrow, fairly high grade deposits of medium size and life. The start of uranium mining activity in Labrador is also expected during the forecast period.

Because of the uncertainties attending nonferrous metal exploration and markets, significant departures from the above most-probable forecast estimates are possible. The least-possible trend assumes diminishing levels of productive activity through the forecast period as current operations are depleted and new exploration results fall below expectations. The most-possible trend assumes a moderate growth in base metal mining activity through the period based on the development to production of four new discoveries and a number of ore extensions to currently producing mines.

Nonmetal Mining

The province's nonmetallic mining industry is expected to grow modestly through the forecast period. The asbestos mining industry is expected to operate at 1967 production levels through the period, output from the fluorspar and pyrophyllite mining industries should grow modestly, and production from the gypsum mining industry will most probably double on the basis of new export markets.

Other Mining

There is currently no primary mineral fuel industry in Newfoundland and Labrador. Although there is a potential for petroleum and natural gas production, particularly on the continental shelf off the southeast coast of the Island of Newfoundland and off the coast of Labrador, and this could begin to be realized in terms of productive activity during the forecast period, provision has not been made for such a development within the terms of the present forecast. However, this potential,

coupled with the metallic mineral resource potential previously mentioned, is expected to stimulate investment in mineral exploration through the period.

Although not a significant factor in the over-all Newfoundland and Labrador mining industry, production from the quarries and sand pits industry is expected to increase moderately over the forecast period.

New Brunswick Forecast

The forecast indicates that economic activity in New Brunswick's mining industry will most probably increase moderately as follows:

	1964 (actual)	1968	1977
Value of Production 1/ (million 1966 $)	35	45	64
Value Added (million 1966 $)	19	25	34
Employment	2,064	3,000	3,300

The relatively small increase in employment over the forecast period reflects the expected rationalization of the labour-intensive coal industry. Investment totalling $90 million is expected to be placed in the New Brunswick mining industry during the period.

Metal Mining

The forecast for the metal mining industry was determined by aggregating forecasts for individual deposits and for the estimated results of new exploration. Individual forecasts were made for currently producing mines and for deposits that, although not yet developed to production, have known economic potential.

Growth in the New Brunswick metal mining industry is essentially dependent on the development of complex nonferrous metal deposits. Generally, lead and zinc are the metals of pri-

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1/ Value of production on the mineral-commodity basis is expected to increase from $92 million in 1968 to $123 million in 1977 (compared with $89 million in 1967).

mary importance and copper and silver are significant byproducts. In a few deposits copper is of primary economic importance. In these complex nonferrous metal deposits, cadmium and gold may also be present in recoverable quantities.

The complex nonferrous metal deposits in New Brunswick are massive and some grade as high as 40 per cent sulphur and 40 per cent iron. Although pyrite is not now recovered, there are possibilities that it may in the future secure commercial markets for sulphur or sulphuric acid manufacture and/or for the production of iron ore concentrate. Indeed, one potential producer views development as essentially a pyrite concentrate opportunity with nonferrous metals recovered as byproducts. For other potential producers with marginal grade deposits, the establishment of markets for pyrite concentrate would render development economically feasible.

New Brunswick also has tin, nickel, manganese and tungsten resource potential. However, it was assumed that this potential would not begin to be realized in terms of productive activity during the forecast period.

Data for the forecast of new exploration results were obtained by the analysis of metallic mineral exploration results for Canada and New Brunswick in the period 1951-1966. Number of discoveries was correlated with exploration expenditure and a forecast was made of possible trends in exploration expenditure per discovery in New Brunswick during the period 1968-1977. Estimates were also made of most-probable, least-possible and most-possible trends in exploration expenditure in the province during the forecast period. On this basis, possible numbers of discoveries during the period were estimated. Exploration and development times, investment, capacity, value of output, mine life and employment estimates were then hypothesized for these forecast discoveries, based on the results of past metallic mineral discoveries in the province.

Given this information, the forecast estimates were determined by making assumptions with respect to three critical areas of uncertainty: lead and zinc markets, pyrite markets, and the recovery problems associated with concentration of the complex nonferrous metal ores.

The most-probable trend assumes that: lead and zinc prices will average 1967 levels through the period; a limited market for pyrite concentrate will develop toward the end of the period; and moderate advances will take place in processing technology, sufficient to encourage the development of the most promising potential producers.

The least-possible trend assumes that: lead and zinc prices will be depressed through the period, forcing cutbacks in output, particularly with respect to metal production; no markets will develop for pyrite concentrate; and minor advances will be made in processing technology.

The most-possible trend assumes that: lead and zinc prices will rise above 1967 levels toward the end of the period; major markets for pyrite concentrate will develop in the second half of the period; and major advances will be achieved in processing technology.

Nonmetal Mining

Two nonmetal mining industries are considered - peat moss and gypsum.

Most-probable, least-possible and most-possible trends for peat moss production assume moderate, minor and major growth rates through the period attending the development of export markets in the United States. Annual output is expected to rise to 85,000 tons by the end of the forecast period. It is expected that mechanized methods will be used to achieve the higher growth rates.

Most-probable, most-possible and least-possible estimates for gypsum production assume minor and major increases and a major decline in production respectively, relative to 1967 levels.

Mineral Fuels

The important forecast component in the mineral fuels industry is the expected rationalization of the Minto coalfield. As New Brunswick coal mining, particularly the underground operations that are expected to be the first phased-out, is relatively labour intensive, 1/ the primary impact of the rationalization program will be on employment. Coal production will most probably decline considerably more than 50 per cent over the forecast period.

New Brunswick petroleum and natural gas production is of minor importance and is expected to decline over the forecast period. The realization of primary potential from possible new discoveries is assumed to lie beyond the forecast period. However, this potential coupled with metallic mineral resource potential is expected to stimulate investment in mineral exploration through the period.

Other Mining

No expansion is foreseen in production from the New Brunswick quarries and sand pits industry over the forecast period.

1/ In 1964 coal mining accounted for 26 per cent of value of production and 40 per cent of employment in the New Brunswick mining industry.

Nova Scotia Forecast

The forecast indicates that economic activity in Nova Scotia's mining industry will most probably decline moderately as follows:

	1964 (actual)	1968	1977
Value of Production 1/ (million 1966 $)	65	72	57
Value Added (million 1966 $)	48	54	43
Employment	7,418	7,200	4,100

The relatively large decline in employment reflects the expected rationalization of the labour-intensive coal industry. Investment totalling $60 million is expected to be placed in the Nova Scotia mining industry during the forecast period.

Mineral Fuels

The most important forecast component is the coal mining industry. The expected rationalization of the industry, reflecting the program approved by the Governments of Canada and Nova Scotia, is the reason for the downward most-probable trend for the provincial mining industry. The coal mining industry currently accounts for over 70 per cent of the value of production of the Nova Scotia mining industry and for about 85 per cent of the employment therein. With respect to the Sydney area mines of the Dominion Steel and Coal Corporation (Dosco), the expected rationalization follows the production, employment and investment trends recommended in the Donald report with implementation assumed to begin in 1968. 2/ According to this scheme, production is reduced through a program of mine closures from a 1967 output of 3.2 million tons to about 2.0 million tons in 1973, then continuing at that rate through the remainder of the forecast period. For coal mines outside the Sydney area, production is expected to decline from 0.5 million tons in 1967 to 0.2 million tons in 1977. 3/ Employment estimates for the

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1/ Value of production on the mineral-commodity basis is expected to decline from $83 million in 1968 to $70 million in 1977 (compared with $79 million in 1967).

2/ Donald, J.R. The Cape Breton coal problem. Ottawa, Queen's Printer, May 1966. Dosco's Sydney area mines were acquired by the Cape Breton Development Corporation (DEVCO), a Crown corporation, on April 1, 1968.

3/ On April 1, 1968 the Government of Nova Scotia assumed complete financial responsibility for the province's independent coal mines.

coal mining industry take into account anticipated changes in productivity through the forecast period.

The realization of primary potential from possible Nova Scotia petroleum and natural gas production is assumed to lie beyond the forecast period. However, this potential coupled with metallic mineral resource potential (discussed below) is expected to stimulate investment in mineral exploration through the period.

Metal Mining

Although there is believed to be considerable long-run potential for developing a metal mining industry in Nova Scotia, it is unlikely that this potential will begin to be realized in terms of productive activity within the forecast period. However, the existence of several large metallic mineral deposits coupled with advancing processing technology and improved market conditions could result in a significant growth in metal mining activity beyond the forecast period.

Nonmetal Mining

There is important growth potential in Nova Scotia's nonmetallic mining industry, and expansion during the forecast period is expected to be significant. This potential is most evident in the salt and gypsum industries which are expected to expand at a moderate rate and which could possibly expand rapidly under favourable market conditions. The impact of possible improvements in processing technology on the province's large gypsum resource base could result in rapid growth for the gypsum mining industry beyond the forecast period. Production in the barite industry is expected to cease during the forecast period due to the depletion of established reserves.

Other Mining

Production from the quarries and sand pits industry is expected to increase modestly over the forecast period.

Prince Edward Island Forecast

Economic activity in the Prince Edward Island mining industry has traditionally been very small, limited to the output of quarries and sand pits. Average annual production over the forecast period will most probably be moderately higher than 1964 levels:

	1964 (estimated)	1968-1977 (average annual)
Value of Production 1/ (million 1966 $)	0.3	0.4
Value Added (million 1966 $)	0.2	0.3
Employment	35	40

No significant investment is expected. Investment in and realization of primary potential from a possible petroleum and natural gas industry is assumed to lie beyond the forecast period.

1/ Value of production on the mineral-commodity basis is expected to average $1.2 million over the forecast period, compared with $1.7 million in 1967.

APPENDIX A

A STATISTICAL EXPLANATION OF THE FORECAST METHOD (CHAPTER 4)

The 10-year period 1968-1977 is assumed for the forecast.

The statistical basis for the forecast chapter is the mining industry, defined in terms of the revised Standard Industrial Classification (S.I.C.)1/ and the 1964 changes in Dominion Bureau of Statistics methodology. The Atlantic Provinces' mining industry has been subdivided into the following five groups:

1) Metal Mining Industry
2) Nonmetal Mining Industry
3) Coal Mining Industry
4) Petroleum, Natural Gas and Mining Service Industries
5) Quarries and Sand Pits Industry

Economic activity in the mining industry, for the purposes of the forecast, is measured in terms of value of production, value added, employment and investment. These measures are defined later in this section. Value statistics are in constant 1966 dollars.

For each of the four measures of economic activity three trends are estimated:

1) most-probable trend - what is most likely or expected;

2) least-possible trend - a lower confidence limit reflecting the realization of very pessimistic conditions for the industry;

3) most-possible trend - an upper confidence limit reflecting the realization of very optimistic conditions for the industry.

The departures of the upper and lower confidence limits from the most-probable trend measure future uncertainties. If expected mining development problems are surmounted, the most-possible trend may be realized. On the other hand, if expected problems in reality intensify, the mining industry may only realize least-possible values.

1/ Standard Industrial Classification Manual, D.B.S.

For statistical purposes, two definitions of mineral production are commonly used: production on an industry basis 1/ and production on a commodity basis. Besides subdividing mineral production on industry and commodity bases respectively, serious differences arise between the two approaches because all mineral commodities are not produced within the mining industry, because the mining industry encompasses non-mineral-commodity activities, and because of differences in valuation procedure and the amount of processing included. These differences are large.

The commodity approach is normally used by groups within the mining industry because of tradition and because it is thought to more realistically portray the industry's productive activity. However, groups responsible for relating the industry's productive activity to a regional, provincial, or national economy use the industry approach because it is part of a standard industrial classification that provides a consistent framework for the compilation of statistical data from different sectors of the economy. The industry approach is particularly important because it relates employment and investment data to output. In this way the full potential of the statistical system is realized.

The Mining-Industry Approach

The objective of the standard industrial classification (S.I.C.) is to provide a common framework so that comparable data can be secured from different statistical sources. The classification is one of industries, not occupations or commodities. One division of the S.I.C. is the mining industry, the components of which are outlined above.

Within the S.I.C. framework, the unit for which data are obtained and which is therefore classified to a particular industry is the establishment. A mining establishment is typically a mine, mine/mill, quarry or pit principally engaged in mining. As of the 1964 changes in D.B.S. methodology, the concept of the establishment is redefined in terms of its total productive activity. Non-productive activities in the mining industry, such as exploration, development, and other mining services, are excluded. These activities do not directly result in mining production and, thus, they make no contribution to mining industry "value of production" and "value added" statistics. However, these activities are important in terms of the job opportunities they provide, and in terms of the investment they place in the mining industry.

1/ The industry approach may be either in terms of the mining industry (as used in the forecast), or in terms of the mineral industry, encompassing the mining industry and mineral-based manufacturing industries.

According to the revised S.I.C., the output, employment, and investment of the primary metal industries, the petroleum and coal products industries, and the nonmetallic mineral products industries are classified to the manufacturing industry, not the mining industry. Thus, the processing of mineral products beyond the milling-beneficiation stage is not considered part of the mining industry. 1/ The petroleum and natural gas industry includes establishments primarily engaged in the production of petroleum and natural gas from wells, and natural gas processing plants, but excludes petroleum refineries.

Measuring Economic Activity in the Mining Industry

Prior to the 1964 changes in methodology, the output of the mining industry in D.B.S. principal statistics was measured by gross output value of products ("gross value") and net value added by processing ("net value"). Gross value was defined as the value of shipments f.o.b. shipping point. Changes were made in 1964 so that mining industry output statistics would be consistent with those used for the manufacturing industries. Thus, the output of the mining industry is now measured in terms of "value of production" and "valued added".

Value of production is the value of the establishment's output f.o.b. shipping point. It excludes excise and manufacturer's sales taxes, forward treatment charges, and freight and transport charges. The value of containers is included unless returnable. Adjustments are made to "shipments" statistics to account for changes in the inventories of finished goods and goods-in-process. Thus, value of production approximates the value the mining establishment receives for its output f.o.b. shipping point. 2/

Value added is obtained by deducting from value of production the cost of fuel and electricity, and process, maintenance and other supplies and materials. Value added is generally considered the most useful measure of output for purposes of provincial analysis. It is this value that is most closely related to Gross Domestic Product in the national accounts.

1/ These mineral-based manufacturing industries (primarily metals, petroleum and coal products, nonmetallic mineral products) would be included in a mineral-industry approach.

2/ It is important to note 1964 changes in D.B.S. methodology whereby metal mining establishments are credited with a value of production based on refined metal value. Exceptions to this general rule include cases where the metal mining establishments's concentrate is exported from Canada. In these cases, value of production is the sale value of the concentrate product.

D.B.S. defines employment as the number of employees engaged in productive activity in the establishment. It includes production and related workers in mineral-producing and non-mineral-producing activities, administrative and office employees, and sales and distribution workers. In the present study, employment in the Atlantic Provinces' mining industry includes as well employees in non-producing activities (exploration, development, and other mining services) because they represent job opportunities created in the mining industry.

D.B.S. investment statistics for the mining industry include on-property exploration expenditures and mine development expenditures, as well as normal capital and repair expenditures. Capital expenditures include the cost of procuring, constructing and installing new durable plant and machinery. Included are all purchases charged to an establishment's fixed assets account as well as capital items charged to operating expenses. Repair expenditures represent outlays made to maintain the operating efficiency of the existing stock of durable physical assets. Investment in the Atlantic Provinces mining industry for the purpose of the present study conforms to this D.B.S. investment framework except that all exploration expenditures are included. Outside or general exploration expenditures are included because they represent an integral and necessary part of the mining industry's investment process.

APPENDIX B

SUMMARY TABLES

B-1 Atlantic Provinces Mining Industry, 1961-64

B-2 Atlantic Provinces Mining Industry, Forecast by Sector, 1968-1977

B-3 Atlantic Provinces Value of Production, Mineral-Commodity Basis, 1961-67

TABLE B-1

Atlantic Provinces Mining Industry, 1961-64

Prov.	Sector	Value of Production (million 1966 $) 1961	1962	1963	1964	Value Added (million 1966 $) 1961	1962	1963	1964	Employment (no.) 1961	1962	1963	1964
Newfoundland	Metal Mining	81	83	116	143	57	55	73	91	3,780	3,710	3,870	4,140
	Nonmetal Mining	3	3	8	12	2	2	6	9	290	290	450	640
	Coal Mining	-	-	-	-	-	-	-	-	-	-	-	-
	Petroleum, Nat. Gas & Mining Services	-	-	-	-	-	-	-	-	180	130	140	160
	Quarries & Sand Pits	1	1	1	1	1	1	1	1	100	70	60	50
	Mining Industry	85	87	125	156	60	58	80	101	4,350	4,200	4,520	4,990
New Brunswick	Metal Mining	-	6	8	22	-	3	4	11	-	980	210	610
	Nonmetal Mining	2	2	2	2	1	1	1	1	410	410	400	390
	Coal Mining	8	7	8	9	6	6	5	6	860	800	820	840
	Petroleum, Nat. Gas & Mining Services	-	-	-	-	-	-	-	-	110	110	80	100
	Quarries & Sand Pits	2	2	2	2	1	1	1	1	140	120	130	120
	Mining Industry	12	17	20	35	8	11	11	19	1,520	2,420	1,640	2,060
Nova Scotia	Metal Mining	-	-	-	-	-	-	-	-	-	-	-	-
	Nonmetal Mining	11	16	17	18	8	11	12	13	890	910	750	1,010
	Coal Mining	46	45	47	45	36	35	36	34	7,200	6,410	6,060	6,220
	Petroleum, Nat. Gas & Mining Services	-	-	-	-	-	-	-	-	20	50	40	50
	Quarries & Sand Pits	2	2	2	2	1	1	1	1	140	140	130	140
	Mining Industry	59	63	66	65	45	47	49	48	8,250	7,510	6,980	7,420
Atlantic Provinces*	Metal Mining	81	89	124	165	57	58	77	102	3,780	4,690	4,080	4,750
	Nonmetal Mining	16	21	27	32	11	14	19	23	1,590	1,610	1,600	2,040
	Coal Mining	54	52	55	54	42	41	41	40	8,060	7,210	6,880	7,060
	Petroleum, Nat. Gas & Mining Services	-	-	-	-	-	-	-	-	310	290	260	310
	Quarries & Sand Pits	5	5	5	5	3	3	3	3	380	380	360	350
	Mining Industry	156	167	211	256	113	116	140	168	14,120	14,180	13,180	14,510

* Including Prince Edward Island.
Less than $0.5 million or 5 employees.
Source: Dominion Bureau of Statistics.

TABLE B-2

Atlantic Provinces Mining Industry,
Forecast by Sector, 1968-1977

	Metal Mining	Nonmetal Mining	Coal Mining	Petr., Nat. Gas Mining Services	Quarries & Sand Pits	Mining Industry
ue of Prod. lion 1966 $)						
1968	257	33	60	-	6	356
1971	293	36	50	-	6	385
1974	305	40	36	-	6	387
1977	365	42	36	-	6	449
lue Added ilion 1966 $)						
1968	160	24	45	-	4	233
1971	181	26	38	-	4	249
1974	189	29	27	-	4	249
1977	226	30	27	-	4	287
mployment (number)						
1968	6,780	2,110	6,810	400	320	16,420
1971	7,730	2,320	4,680	400	320	15,450
1974	7,900	2,470	3,080	540	340	14,330
1977	9,210	2,620	2,980	540	340	15,690
umulative nvestment ilion 1966 $)						
1968	54	3	7	5	1	70
1971	213	11	22	22	6	274
1974	384	18	27	42	10	481
1977	564	28	30	65	14	701

TABLE B-3

Atlantic Provinces Value of Production, Mineral-Commodity Basis, 1961-67

(million 1966 $)

Prov	Commodity Group	1961	1962	1963	1964	1965	1966	1967
New-foundland	Metallic Minerals	93	100	132	176	210	225	238
	Nonmetallic Minerals	3	3	7	11	11	13	13
	Coal	-	-	-	-	-	-	-
	Other Fuels	-	-	-	-	-	-	-
	Structural Materials	6	7	7	6	6	6	4
	Total Mineral Commodities	102	110	146	193	227	244	255
New Brunswick	Metallic Minerals	-	4	10	31	65	69	67
	Nonmetallic Minerals	1	2	1	1	2	2	2
	Coal	8	8	8	9	9	8	8
	Other Fuels	-	-	-	-	-	-	-
	Structural Materials	11	10	11	10	9	11	12
	Total Mineral Commodities	20	24	30	51	85	90	89
Nova Scotia	Metallic Minerals	-	2	1	2	2	2	-
	Nonmetallic Minerals	11	13	15	15	16	15	13
	Coal	47	45	47	45	47	51	51
	Other Fuels	-	-	-	-	-	-	-
	Structural Materials	10	6	8	7	9	17	14
	Total Mineral Commodities	68	66	71	69	74	85	78
Atlantic Provinces*	Metallic Minerals	93	106	143	209	277	296	305
	Nonmetallic Minerals	15	18	23	27	29	30	28
	Coal	55	53	55	54	56	59	59
	Other Fuels	-	-	-	-	-	-	-
	Structural Materials	28	24	27	24	25	37	32
	Total Mineral Commodities	191	201	248	314	387	422	424

* Including Prince Edward Island.

-: Less than $0.5 million.

Source: Dominion Bureau of Statistics.

Background Study No 5

PROFILES OF EDUCATION in the ATLANTIC PROVINCES

ATLANTIC DEVELOPMENT BOARD

Background Study No. 5

PROFILES OF EDUCATION
in the
ATLANTIC PROVINCES

ATLANTIC DEVELOPMENT BOARD

OTTAWA

1969

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FOREWORD

This report is the fifth of a series initiated by the Atlantic Development Board to examine important aspects of the economy of the Atlantic Region. It was prepared as a background document for public discussion of regional development policies.

The Atlantic Development Board Act authorizes the Board to prepare "... an overall co-ordinated plan for the promotion of the economic growth of the Atlantic Region". The various studies that the Board has prepared provide the basic facts on which development policies will be formulated. They are being published to contribute to public understanding and discussion of the major policy issues in the economic development of the Atlantic Provinces.

This report examines three major aspects of education in the Atlantic Provinces. Parts One and Two focus on the primary and secondary components of the education system and on the effects of various demographic and economic factors on the outputs of that system. Part Three describes some of the features of post-secondary education. Part Four attempts to project enrolments and numbers of teachers into the 1980's. As a whole, the report brings together, for the first time, much current data on education in the region and identifies some of the major gaps in existing information.

The report combines a number of separate studies commissioned by the Atlantic Development Board. Major contributions were made by Dr. J.E. Cheal, Faculty of Education, Department of Educational Administration, University of Calgary; by Dr. H.W. Kitchen of Memorial University, Newfoundland; by Dr. C.B. Conway, Department of Education, Province of British Columbia; and by the Atlantic Provinces Economic Council in Halifax. Dr. D.E. Foohey co-ordinated the study for the Board and, with the editorial assistance of J.F. Kinzel, prepared it for publication.

The study was undertaken with the assistance of an intergovernmental advisory committee consisting of representatives of provincial and federal government agencies and non-governmental personnel:

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C. Wenaas, Economic Council of Canada, Ottawa;

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Dr. Z.E. Zsigmond, Education Division, Dominion Bureau of Statistics, Ottawa.

Their participation in an advisory capacity, of course, does not imply any measure of responsibility for the report or its findings

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PART ONE - DEMOGRAPHIC AND SOCIOECONOMIC FACTORS RELATED TO EDUCATION

PART TWO - INTERPROVINCIAL DIFFERENCES IN ELEMENTARY AND SECONDARY EDUCATION

PART THREE - POST-SECONDARY EDUCATION

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APPENDIXES - A. Statistical Tables and Correlation Matrixes (Part One)

B. Statistical Tables (Part Two)

C. Limitations of Data and Assumptions Underlying Post-Secondary Enrolment Forecasts (Part Four)

Detailed Tables of Contents precede each Part.

INTRODUCTION

This introduction presents in summary form the purpose and plan of the study. It outlines some of the current concepts of the role which education must play in preparing young people to take their place in a rapidly changing, highly industrialized and highly urbanized society and it discusses the scope and sequence of the report.

Human Resource Development

The key to all progress - individual, social, economic, and political - is human resource development. This development involves the exploration, discovery, refinement, and utilization of untapped reserves of human talent. It requires research, organization and efficient management. It demands the investment of both physical and human capital. It is the most challenging responsibility of our society and the chief function of education.

World-wide recognition is now being given to the fact that the real wealth and security of any society lie in the human resources at its command. Natural resources and physical capital alone are not sufficient to ensure either economic progress or social well-being. Only human wisdom and skill can make these elements productive and direct them toward those ends which lead to both a higher standard of living and a more satisfying way of life.

Canadian society has long recognized the need for large investments in physical capital and natural resource development. It has been generally aware that there are great reserves of primary resources still to be discovered, explored or developed. Exploration, development and research are conceded to be activities essential for the growth of our economy. Major industries budget substantial sums for their support, and many firms devote themselves wholly to these aspects of production. There is increasing awareness also of the necessity of conserving our natural heritage through the careful husbanding and efficient utilization of our physical resources. The long-range needs of our economy for a dependable supply of these resources are readily acknowledged. Strenuous efforts are made to attract the needed investment capital - public and private, domestic and foreign - that our reserves of natural resources may be discovered, developed and conserved.

Canadians have been very much slower to recognize the significance to our national life of investment in human capital and the development of human resources. Long-range educational planning has been almost nonexistent. Research and development

have been treated as unnecessary frills which taxpayers could hardly afford. Our society has been content with only a surface assessment of its human resources and has attempted to meet conspicuous shortages of educated manpower by immigration rather than by investment. Only in recent years has the rapid urbanization and industrialization of our national life resulted in economic, political and social problems which have forced us to awaken to the urgent demand for human resource development. Only as the full potential of each member of society is realized and developed can those individual and national problems be resolved which stem from inadequate skills, limited understandings and a restricted world view.

Education has too long been viewed by Canadian society as only a consumer good, as an institution whose prime function is to perpetuate the values and transmit the culture of previous generations. To education has been assigned the traditional task of cultivating elites - social, economic or intellectual. But this view of education and its function is no longer adequate. Education must be relevant to today's demands. Literacy alone is not enough. Opportunities for further education cannot be restricted to the few. Today, only the fullest development of all human talents will meet the needs of society and satisfy the demands of the individual.

Economists are now beginning to recognize the importance of education as a major producer good. Its significant contribution to the growth of the economy is being realized. While losing none of its cultural value to the individual or society, education is being acknowledged as a form of human capital which produces a rate of return as high as that accruing to physical capital. Without sufficient investment in human capital the growth of the economy is retarded. Without sufficient knowledge and skill development, the individual is unemployable. To be relevant to today's demands education must not only provide a link to the past but it must also provide a bridge to the future. "From the economic and social standpoint, a country's educational system is its main means both of perpetuating the values and skills of its population, and of preparing it for the changes which progress requires."1/

The Goals of Education

The goals of education have been the subject of much discussion and debate since antiquity. The philosophical aims of education and its operational objectives are subject to review and redefinition as changing conditions demand new emphases. Two dominant themes, however, continue to present themselves in all discussions of educational goals: education for personal development and education for social competence.

1/ Economic and Social Aspects of Educational Planning. UNESCO, 1964. p. 11.

The personal goals of education are those which relate to the development of attributes and abilities which enable the individual to have a successful and satisfying life experience. The social goals of education are those which relate to the needs of the social, political and economic institutions of society. These two sets of goals are not mutually exclusive, there are many interrelationships. They do suggest different emphases, however, and some balance must be maintained between them.

Associated with each of these general goals of education are both cultural and economic aspects. In order to achieve the personal goals of education not only must the talents of the individual be discovered and developed, and some understanding and appreciation of his cultural heritage be established, but the knowledge and skills necessary to enter the labour force and earn the economic means to satisfy basic needs and wants must also be acquired. In providing a program which will meet the social goals of education it is necessary to include not only those experiences which contribute to the perpetuation and development of our social and political institutions, but also those which will meet the changing needs of the economy.

Education and the economy may be seen as two institutions of our society which have a reciprocal relationship, the output of one contributing to the input of the other. The levels of schooling attained by entrants into the labour force have been found to be important determiners of its productivity. Productivity, in turn, affects levels of income, and income levels largely determine expenditure on education. Expenditure levels on education are highly associated with the output levels of the educational system, that is with the levels of schooling of those entering the labour force. Where levels of schooling are low, productivity and income are low, and ability to make expenditures on education is also low. Where levels of education and income are higher the greater ability to invest in education is usually accompanied by a greater desire to do so. Its value as a form of investment is more readily seen and appreciated.

There are three levels of education which have a direct or indirect relationship to levels of occupation and income. These are elementary, secondary, and post-secondary education. Although the direct relationship between the various forms of post-secondary education and levels of occupation and income in the labour force is readily apparent, the more indirect relationships between elementary and secondary education and occupation and income are no less significant. It is at these levels that attitudes and skills, as well as basic knowledge and concepts, are established. Success in the higher levels of education and in the labour force, may depend very considerably on the strength of the foundation which has been laid at these lower levels.

The allocation of resources among the various levels of education involves policy decisions which must take into con-

sideration both the stage of development through which the economy is passing and the stage of development through which education is passing. An economy which has evolved to the point where its use of technology demands a large number of technical and middle-management personnel will have to make a larger allocation of its resources to the post-secondary sector. However, if low levels of investment in elementary and secondary education have produced high dropout rates so that insufficient numbers of students are eligible to enter post-secondary programs, larger inputs of resources may first have to be allocated to those sectors before further investment in post-secondary education is profitable.

Very often enlarged economic opportunities have to be visible on the horizon before individuals or societies recognize the need for a greater investment of time, energy and resources in education. The establishment of new industries may provide occupational opportunities which, in time, will create incentives for further education investment. On the other hand, the provision of new educational facilities, particularly for post-secondary education, may create a demand for educational opportunities which had not existed before. The more education a society has, the more it is likely to demand, and the greater will be its willingness and ability to pay for it.

Since the demand for education is strongly influenced by the distance between the consumer and the location of the educational institutes, a concentration of activities and population in larger "growth centres" will raise demand appreciably. Not only is per-capita demand for education greater in larger centres, but it is also more varied. The supply of educational facilities makes the area more attractive to industry and thereby contributes indirectly to the area's welfare. This is especially the case with industries that employ large numbers of professional and semi-professional workers. Such workers are highly mobile and are also likely to demand superior educational facilities for themselves and their children.

While the economic aspects of education are receiving increasing recognition, and are of particular interest to educational planners, its consumer aspects have lost none of their significance. The growing personal and social ills associated with our highly industrialized and urbanized society emphasize the necessity of recognizing and re-examining the cultural goals of education. It is impossible, of course, to attain the economic goals of education without achieving at the same time some of the social goals, or to attain the cultural goals without achieving some of the economic goals, but both need specific consideration and continual re-evaluation.

> In developing manpower for economic growth, education need not neglect the development of the individual and the higher aims of society; in strengthening science and technology, it need not weaken the humanities; in

adopting modern methods, it need not abandon the best of the old. But the necessity of adjusting to an age of development and of expanding educational opportunities for everyone, forces us all to re-examine critically the educational legacies of the past, to dig fearlessly beneath old labels and practices, and to take calculated risks with promising new methods and concepts. There are certainly dangers in too narrow an interpretation of the role of education, in too great an emphasis on education as a source of qualified manpower. But there is the even greater danger of failing to admit that much of what goes on in the name of education today serves none of the great aims of education well enough, neither those which are stressed by the economists, nor those, more traditional ones, which educators are rightly anxious to preserve.1/

Assumptions and Implications

Underlying these statements of educational objectives are certain basic assumptions, and growing out of them are certain implications for educational practice. The assumptions may be listed as follows:

1) All Canadians, regardless of cultural background or geographic location, have an equal right to educational opportunities.

2) Equality of opportunity implies not necessarily the same education for all, but equal opportunity to develop individual potential.

3) The educational system must provide an educational program which will meet the changing cultural needs of individuals and of society.

4) The educational system must provide an educational program which will meet the changing economic needs of individuals and of society.

5) The elementary and secondary sectors of the education system must provide that foundation of knowledge, skills, and attitudes which will permit successful entry into post-secondary education or into the labour force.

1/ Problems and Strategies of Educational Planning: Lessons from Latin America. UNESCO: International Institute for Educational Planning, 1965. p. 10.

6) The secondary and post-secondary sectors of the educational system must provide appropriate general education to enable members of the labour force to adapt to changing conditions through further training, or retraining.

7) The educational system should include in its program those experiences which will allow its graduates to understand and provide solutions for the social problems of an urbanized and industrialized society.

Acceptance of the above list of assumptions, which underlie the stated goals of education, has the following general implications for educational practice:

1) The teaching profession must have a clear understanding of the generally accepted goals of education and sufficient professional competence to be able to operationalize them.

2) The instructional program must be broad enough to encompass these aims and sufficiently comprehensive to take care of a wide range of differences among the needs, abilities and interests of individual students and communities.

3) The teaching profession must have sufficient professional preparation and specialized skills to adapt both programs and methodology to these pupil and community differences.

4) Instruction must be of such a calibre that a high percentage of pupils are retained through the secondary school program and leave with a desire to continue their education, either formally or informally, during their adult lives.

5) Adequate resources of materials, facilities, and instructional personnel must be available to make effective educational programs possible.

6) Facilities for a wide variety of educational opportunities at the secondary and post-secondary levels must be provided in such a manner that geographic location, economic ability or cultural background do not restrict entry.

Plan of the Report

The series of studies reported here is broadly concerned first with an analysis of the education systems of the Atlantic Provinces to determine the state of their development, the nature and effect of the investment which is being made, and

the factors which restrict the contribution of the education systems to the development of the Region's human resource potential. Second, an attempt is made to project future needs in terms of student enrolments and teacher requirements through the post-secondary level.

Part One considers some of the factors which determine the environment within which the education systems operate. Specifically, it looks at socio-economic and demographic variables in each of the Atlantic Provinces and examines their possible relationships to educational achievement (i.e., to certain measures of output of the education systems). In a sense, it serves as a warning that to increase educational inputs alone may not be enough; broader social and economic needs must be considered as well.

Part Two examines primary and secondary education in the Atlantic Provinces. Input and output variables of the education systems of the Atlantic Provinces and of the four Western Provinces are compared on an interprovincial and interregional basis. "Input" and "output" variables are defined in appropriate sections. In general, inputs include pupils (education need and education load), teachers (numbers, distribution and qualifications), and financial expenditures. School size is also given limited consideration as an input, and reference is made to school organization. The definition and measurement of educational output is one of the most difficult problems in research. For the purposes of Part Two, pupil retention and grade completion rates are used as the main output measures. Retardation - used as a negative measurement of output - refers to pupils one year or more older than the modal group for any grade. Retardation is related to school failure.

Part Three turns to a consideration of post-secondary education - principally universities, colleges and technical institutes. The institutions and their geographical distribution are described, together with a brief report on library resources. Characteristics and qualifications of teaching staff are examined and university teachers' salaries in the Atlantic Provinces are compared to those in other Canadian regions. Financial inputs are briefly analysed.

The concluding part, Part Four, examines school-age and university-age population projections and attempts to forecast enrolments to 1986-87 in each of the Atlantic Provinces in two categories: (1) elementary and secondary combined, and (2) post-secondary. Future numbers of teachers in the two categories are also estimated, and, for elementary and secondary schools, annual additions to teaching staff are forecast.

Throughout the study, every attempt has been made to present the most recent data available. Despite these attempts, some information unavoidably refers to periods four and five years prior to the date of publication. However, the relative positions described are still very much the same.

Among the several aspects of education not considered in this report is technical and vocational training (except for certain post-secondary technical institutes). Demand for and supply of skilled manpower in the Atlantic Provinces is the subject of a separate report not yet published.

PROFILES OF EDUCATION
in the
ATLANTIC PROVINCES

PART ONE

DEMOGRAPHIC AND SOCIO-
ECONOMIC FACTORS
RELATED TO EDUCATION

PART ONE

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PART ONE

DEMOGRAPHIC AND SOCIOECONOMIC FACTORS RELATED TO EDUCATION

There is evidence that today's educational problems in the Atlantic Provinces are rooted in the whole way of life of the region, including the low educational attainment of earlier generations. Specifically, low educational outputs and high retardation1/ rates appear to be related more to socioeconomic and demographic factors, such as adult illiteracy, family size and non-employment, than to such educational factors as the qualifications and salaries of teachers. These problems, as manifested in the Atlantic Region, are examined in the sections below.

Within New Brunswick, differences in high school retention rates among counties were found to be related more highly to family size and to percentage of adult illiteracy than to teacher qualifications and salaries. Similarly, in Newfoundland, correlations suggest the crux of lower educational productivity to be the non-literate environments provided by many of the smaller outports. The analysis for Nova Scotia presented a less clear picture of the variables underlying differences in the educational output of the various counties; there were, however, suggestions that output is lower in those counties characterized by relatively larger families, greater illiteracy and lower levels of employment. For Prince Edward Island, with only three counties, correlational analysis was not useful.

Over-all analysis of the 45 counties and census divisions of the Atlantic Provinces again suggested that retention and progress in school are related more highly to socioeconomic variables than to variations in educational input. Similar data emerge from comparisons among the ten provinces. For the three five-year periods 1951-56, 1956-61, and 1961-66, there has been migration from each of the Atlantic Provinces and from almost all of their census divisions and counties.

It follows that successful attempts to increase educational output must probably go beyond the raising of teachers' salaries and qualifications, important as these are. The more basic problems of chronic non-employment, adult illiteracy, fatalism, and large families are even more critical, and ways to counteract their effects upon each succeeding generation will need to be found.

1/ "Retardation" refers to those students who, for whatever reason, are over-age relative to the norm for a particular grade.

The remainder of this Part is divided into three sections. The first is a compilation of data for the Atlantic Provinces on demographic and socioeconomic variables, most of which have been identified by studies elsewhere as being related to educational productivity. The second section reports the relationships that were found for the Atlantic Provinces between seven measures of educational output and 20 demographic and socioeconomic measures that were classified as inputs. Finally, the findings are briefly summarized.

1. DEMOGRAPHIC AND ECONOMIC ASPECTS

Studies conducted elsewhere have presented rather strong evidence that educational achievement is related directly to the economic well-being of the community (Rossi, 1961; Bloom *et al*., 1965), to the socioeconomic status of the family (Davis, 1948; Eells *et al*., 1951), and to the degree of literacy of the child's environment - particularly his home (Robinson, 1946), but inversely to size of family (Nisbet, 1961). In urban areas, educational achievement is usually higher than in small towns or rural areas (Downey, 1965). Children from homes whose language is other than the dominant one are often at an educational disadvantage (Nisbet, 1961).

In this section data on factors similar to those cited above are examined for the Atlantic Provinces. Included are: the extent of illiteracy in each of the provinces; family size; the proportion of the population living in small settlements; and characteristics of the labour force, including personal income. Data are also presented on the extent of emigration.

Educationally Deprived Environment

A factor that will be identified later as relating strongly but inversely to educational output in the Atlantic Provinces is educational deprivation, or illiteracy and functional illiteracy, in the social environment. Educationally deprived environment is most acute in Newfoundland and New Brunswick, among older people, in smaller communities.

Table 1-1 indicates that, in 1961, in both Nova Scotia and Prince Edward Island, the illiterate plus the functionally illiterate comprised a proportion of the population similar to that in Canada as a whole. However, rates for New Brunswick were almost 50 per cent above the national average; for Newfoundland, more than 100 per cent. Moreover, all four Atlantic Provinces were below the national average in the proportion of people who have attended university.

TABLE 1-1

Percentages of Population who are Illiterate, Functionally Illiterate, and University Educated, Atlantic Provinces, 1961

	Illiterate	Functionally Illiterate	Illiterate plus Functionally Illiterate	University Educated
	%	%	%	%
Nfld.	8.1	18.4	26.4	3.1
P.E.I.	3.4	6.4	9.8	4.2
N.S.	4.2	6.7	10.9	5.0
N.B.	5.0	10.7	15.7	4.5
Canada	2.8	8.0	10.8	6.0

Source: Derived from Census of Canada, 1961. Percentages are based on the population 6 years and over not at school. In the census, the terms "no schooling" and "having less than Grade 5" are used instead of "illiterate" and "functionally illiterate".

Newfoundland

Table 1-2 shows how illiteracy and functional illiteracy were distributed among Newfoundland's census divisions. Everywhere - except on the Avalon Peninsula and in the areas of Corner Brook and Grand Falls - one-third of the non-school population above five years of age was functionally illiterate.[1] In six of these divisions, fewer than 2 per cent had ever attended university, a rate just one-third the national average.

Tables 1-3 and 1-4 indicate that, in 1961, illiteracy was much more prevalent in the smaller settlements of the province where 27 per cent of the population above 10 years of age was illiterate or functionally illiterate, compared to less than half that rate in the larger settlements, and to less than one-quarter that rate in St. John's. Later it will be shown that when the degree of illiteracy or functional illiteracy of the census divisions in Newfoundland was related to the percentage of people in the divisions living in settlements under 1,000 population, the correlation was found to be very high (.91).

1/ Differences may be attributable in part to differences in the age at which children are admitted into school.

TABLE 1-2

Percentages of Population who are Illiterate, Illiterate or Functionally Illiterate, and University Educated, Census Divisions of Newfoundland, 1961

Census Division	Illiterate	Illiterate plus Functionally Illiterate	University Educated
	%	%	%
1	8.4	21.3	3.8
2	13.9	37.7	1.9
3	17.1	44.5	1.3
4	15.5	34.5	2.5
5	10.4	24.1	3.4
6	8.3	21.4	4.2
7	11.9	37.8	1.4
8	12.5	38.9	1.3
9	16.7	43.6	1.2
10	17.2	33.7	4.5
Newfoundland	11.0	28.8	3.0

Source: Derived from Census of Canada, 1961. Percentages are based on the population 5 years and over not at school.

TABLE 1-3

Proportions of Population who are Illiterate, by Rural-Urban Residence and by Age Group, Newfoundland, 1961

Age Group	Settlements under 1,000	Settlements 1,000 and over	St. John's	All Newfoundland
	%	%	%	%
10-14	0.5	0.4	0.3	0.5
15-19	0.7	0.4	0.2	0.5
20-24	1.7	0.5	0.2	1.0
25-34	3.7	1.3	0.7	2.4
35-44	6.7	2.9	1.1	4.6
45-64	9.4	4.5	1.9	6.8
65+	23.1	12.7	5.9	18.2
All ages (10+)	5.9	2.6	1.3	4.2

Source: Derived from Census of Canada, 1961. Percentages are based on the population aged 10 and over.

TABLE 1-4

Proportions of Population who are Illiterate or Functionally Illiterate, by Rural-Urban Residence and by Age Group, Newfoundland, 1961

Age Group	Settlements under 1,000	Settlements 1,000 and over	St. John's	All Newfoundland
	%	%	%	%
10-14	1.9	1.1	0.7	1.6
15-19	3.4	1.4	0.8	2.3
20-24	7.9	2.4	1.1	4.8
25-34	19.0	7.8	3.2	12.8
35-44	36.9	15.6	6.3	25.4
45-64	45.2	22.6	10.1	33.6
65+	64.9	40.9	22.2	53.9
All ages (10+)	26.7	11.7	6.0	18.0

Source: Derived from Census of Canada, 1961. Percentages are based on the population aged 10 and over.

Noteworthy also was the tendency for illiteracy and functional illiteracy to be more prevalent in older age groups, that is, among the grandparents of today's young children, the parents of today's high school pupils.

Thus, illiteracy in Newfoundland was double the national average and was more than twice as prevalent in smaller settlements as in larger ones. In these smaller settlements (where 47 per cent of the people of Newfoundland lived in 1961) 40 per cent of those over 25 years of age were functionally illiterate, 52 per cent of those over 45. It is in these small settlements that the schools face a tremendous challenge, especially since it is in these places that problems of teacher supply and school plant are most acute.1/

New Brunswick

Illiteracy and functional illiteracy, as shown in Table 1-5, were much less prevalent in New Brunswick than in Newfoundland, with only the two counties of Kent and Gloucester having one-third or more of their non-school population above five years old in these categories. Only in Kent had fewer than 2 per cent of that group been to university. However, when compar-

1/ For supporting data, see Newfoundland and Labrador (1967) and Kitchen (1966a).

TABLE 1-5

Percentages of Population who are Illiterate, Illiterate or Functionally Illiterate, and University Educated, Counties of New Brunswick, 1961

County	Illiterate	Illiterate plus Functionally Illiterate	University Educated
	%	%	%
Albert	6.6	11.4	5.8
Carleton	6.7	12.4	4.1
Charlotte	5.3	9.7	4.1
Gloucester	15.3	37.7	2.4
Kent	12.8	34.2	1.4
Kings	5.8	11.3	5.8
Madawaska	13.3	30.7	3.9
Northumberland	9.8	21.7	3.1
Queens	6.5	16.1	3.1
Restigouche	14.3	29.3	3.1
Saint John	5.7	10.8	5.0
Sunbury	8.8	16.1	3.3
Victoria	10.4	22.4	4.0
Westmorland	6.8	14.2	5.3
York	5.7	11.0	6.7
New Brunswick	8.8	19.0	4.3

Source: Derived from Census of Canada, 1961. Percentages are based on the population 5 years and over not attending school.

ed to the national average of 13.4 per cent illiterate or functionally illiterate, seven other New Brunswick counties exceeded the national average. These nine counties comprise the north-eastern two-thirds of the province. Similarly, all counties but Albert, Kings and York were below the national average with respect to the proportion of people who had attended university.

Table 1-6 indicates that, as in Newfoundland, the prevalence of illiteracy in settlements under 1,000 was more than double the rate for larger settlements. Also, it was more prevalent among older people, those of the age to be parents or grandparents. In the smaller settlements, where 43 per cent of New Brunswickers lived in 1961, 21 per cent of those who had reached 25 years of age were illiterate or functionally illiterate, 28 per cent of those who had reached 45. About 10 per cent of New Brunswick's population were classified as farm dwellers in 1961. Of those aged 25 and over, 18 per cent were illiterate or functionally illiterate compared to 22 per cent of those who had reached 45.

TABLE 1-6

Proportions of Population who are Illiterate or Functionally Illiterate, by Rural-Urban Residence and by Age Group, New Brunswick, 1961

Age Group	Farms	Settlements under 1,000	Settlements 1,000 and over	Saint John	All N.B.
	%	%	%	%	%
10-14	0.9	1.5	0.8	1.0	1.1
15-19	2.7	4.1	1.5	0.7	2.8
20-24	4.7	6.6	2.0	1.3	4.1
25-34	10.6	12.4	4.0	3.0	8.0
35-44	12.9	17.2	6.0	4.6	11.2
45-64	19.1	24.6	10.7	7.5	17.1
65+	27.9	33.9	17.6	10.9	25.7
All ages (10+)	11.7	14.4	6.3	4.6	10.3

Source: Derived from Census of Canada, 1961. Percentages are based on the population aged 10 and over.

Thus, in rural New Brunswick, particularly in the small settlements, and especially in the counties of the northeast, the schools with meagre resources of personnel and equipment must contend against an educational environment that was severely disadvantaged in 1961 and, presumably, remains relatively disadvantaged today.

Prince Edward Island

The incidence of illiteracy in Prince Edward Island was below the national average and only 60 per cent of that in New Brunswick (Table 1-7). Farm dwellers in this province, as indicated in Table 1-8, tended to resemble the inhabitants of the larger towns with respect to this variable. However, in small towns, where one-third the people lived in 1961, the incidence was double that of larger towns. Moreover, in Kings and Prince counties, the proportions with university education were, at 2.0 and 2.8 per cent, far below the national average.

TABLE 1-7

Percentages of Population who are Illiterate, Illiterate or Functionally Illiterate, and University Educated, Counties of Prince Edward Island, 1961

County	Illiterate	Illiterate plus Functionally Illiterate	University Educated
	%	%	%
Kings	6.3	13.4	2.0
Prince	6.8	14.5	2.8
Queens	5.5	10.1	6.0
Prince Edward Island	6.1	12.3	4.1

Source: Derived from Census of Canada, 1961. Percentages are based on the population 5 years and over not at school.

TABLE 1-8

Proportions of Population who are Illiterate or Functionally Illiterate, by Rural-Urban Residence and by Age Group, Prince Edward Island, 1961

Age Group	Farms	Settlements under 1,000	Settlements 1,000 and over	All P.E.I.
	%	%	%	%
10-14	1.0	1.3	0.8	1.1
15-19	1.3	3.1	0.9	1.7
20-24	2.5	3.8	1.1	2.4
25-34	3.5	6.1	2.4	4.1
35-44	4.2	8.0	3.3	5.2
45-64	7.0	14.9	6.1	9.2
65+	9.3	16.2	11.7	12.6
All ages (10+)	4.6	8.5	4.0	5.7

Source: Derived from Census of Canada, 1961. Percentages are based on the population aged 10 and over.

Nova Scotia

Nova Scotia had less illiteracy and functional illiteracy than the other Atlantic Provinces. However, there were counties above the national average for both categories combined (Table 1-9), notably Richmond (24 per cent), Guysborough (21 per cent) and Inverness (19 per cent). Only 1.9 per cent of the population of Richmond county had attended university. Apart from Antigonish, Halifax, and Kings, all counties were below the national average on university attendance.

In Nova Scotia, illiteracy was more prevalent on farms and in small communities than in the larger settlements (Table 1-10).

TABLE 1-9

Percentages of Population who are Illiterate, Illiterate or Functionally Illiterate, and University Educated, Counties of Nova Scotia, 1961

County	Illiterate	Illiterate plus Functionally Illiterate	University Educated
	%	%	%
Annapolis	3.5	8.1	4.7
Antigonish	5.2	12.4	8.7
Cape Breton	4.9	12.5	3.6
Colchester	3.2	7.3	4.4
Cumberland	4.1	10.8	3.6
Digby	4.7	16.3	3.0
Guysborough	6.5	20.9	2.2
Halifax	4.0	8.1	7.5
Hants	4.0	10.3	3.9
Inverness	5.9	19.1	2.9
Kings	4.1	8.9	6.1
Lunenburg	3.7	14.8	2.8
Pictou	3.4	8.9	3.5
Queens	5.2	15.4	3.9
Richmond	7.1	24.3	1.9
Shelburne	3.8	12.5	2.5
Victoria	5.2	14.8	2.7
Yarmouth	4.9	14.2	3.2
Nova Scotia	4.3	11.0	5.0

Source: Derived from Census of Canada, 1961. Percentages are based on the population 5 years and over not at school.

TABLE 1-10

Proportions of Population who are Illiterate or Functionally Illiterate, by Rural-Urban Residence and by Age Group, Nova Scotia, 1961

Age Group	Farms	Settlements under 1,000	Settlements 1,000 and over	Halifax	All N.S.
	%	%	%	%	%
10-14	1.5	0.9	0.9	1.0	1.0
15-19	2.3	2.0	1.0	0.5	1.5
20-24	5.2	3.2	1.3	0.8	2.1
25-34	6.8	4.9	2.7	2.2	3.7
35-44	7.1	7.3	3.5	2.9	5.2
45-64	11.8	13.9	7.5	5.7	10.2
65+	18.9	23.0	15.8	10.9	19.1
All ages (10+)	8.8	8.4	4.7	3.4	6.4

Source: Derived from Census of Canada, 1961. Percentages are based on the population aged 10 and over.

Family Size

An important variable underlying educational output, as indicated earlier in this chapter, is family size, particularly number of children. Table 1-11 indicates a major difference in 1961 between the family in the five eastern provinces and the family in the five western provinces: the family of eastern Canada contained 0.5 children more. Also, there were more multiple family households. Newfoundland was most atypical, with at least 0.5 more children per family than the other Atlantic Provinces and at least 1.0 child more per family than the five western provinces. Also in Newfoundland there were 50 per cent more multiple-family households than in the other Atlantic Provinces, about three or four times as many as in western Canada. Newfoundland was unique in Canada in that for every three households there was a person other than father, mother and children. Presumably, these extra persons comprised, to a large extent, grandparents and unmarried siblings of father or mother. Thus two factors - higher incidence of adult illiteracy and greater numbers of adults per household - combined to provide for the child of the Atlantic Provinces, especially in Newfoundland, a far greater probability than for the child of western Canada of being reared in an educationally deprived home environment.

TABLE 1-11

Differences in Family Size among the Provinces of Canada, 1961

Province	Households With Two or More Families	Persons per Household	Children per Family	Extra Persons per Household*
	%	no.	no.	no.
Nfld.	7.5	5.0	2.7	0.3
P.E.I.	5.0	4.2	2.2	-
N.S.	4.8	4.0	2.0	-
N.B.	4.6	4.4	2.3	0.1
Qué.	3.3	4.2	2.2	-
Ont.	4.6	3.7	1.6	-0.1
Man.	3.1	3.7	1.7	-
Sask.	1.9	3.6	1.8	-0.2
Alta.	2.1	3.7	1.8	-0.1
B.C.	2.3	3.4	1.6	-0.2
Canada	3.7	3.9	1.9	-

* "Extra Persons per Household" refers to persons other than one average family of two parents plus children.

Source: Derived from Census of Canada, 1961.

Small Towns

Small towns of several hundred people often pose serious educational problems. Farm dwellers usually send their children willingly to consolidated elementary or secondary schools, for it is obvious to farmers as well as to educators that a farming community is not a viable educational unit today. Neither is a small town. But this is rarely acknowledged by residents. As small towns become less viable economically, and as roads and communications media render them less significant as social units, often the school becomes an increasingly important symbol of the town's identity, something that must be retained if at all possible. As selective mobility operates to take the capable young to the city or to other parts of the nation, educational decisions tend to be made by those to whom local tradition is important. Often, small inadequate schools are retained for other than educational reasons.

A recent Newfoundland study found that the more the high school pupils were involved in small communities, especially small isolated outports, the more involved with adult illiteracy and the less with urban and literate environments, then the more fatalistic they were, the less able to see themselves as improv-

ing their "lot" (Kitchen, 1966b). Thus fatalism is added to the impediments to education in small towns.

The Atlantic Provinces are full of small towns. This is perhaps the most striking aspect of the demography of the area. Those living in settlements under 1,000 in 1961 (classified in the census as "rural non-farm") comprised 35 to 47 percent of the population in the Atlantic Provinces, about double the proportion elsewhere in Canada. Conversely, there were comparatively few people in the Atlantic Provinces who lived in large settlements (Table 1-12).

TABLE 1-12

Per Cent of Population in Communities of Various Sizes, Provinces of Canada, 1961

Province	Rural Non-Farm	Urban	In Centres of 10,000 or more	In Centres of 100,000 or more
	%	%	%	%
Newfoundland	47	51	29	-
Prince Edward Island	35	32	18	-
Nova Scotia	38	54	44	38
New Brunswick	43	47	33	-
Québec	15	76	63	50
Ontario	15	77	67	48
Manitoba	18	64	56	51
Saskatchewan	24	43	27	12
Alberta	15	63	51	46
British Columbia	23	73	63	53
Canada	19	70	59	43

Source: Derived from Census of Canada, 1961.

Economic Factors

More than ten years ago the Royal Commission on Canada's Economic Prospects (1957) commented on the low incomes in the Atlantic Provinces, and suggested some underlying causes:

> As previously noted, one of the most striking features of the economy of the Atlantic Provinces is the disproportionately large number of people engaged in marginal activities, subsistence farming, fishing and logging, or some combination of these. Such occupations are the source of the low incomes which seriously affect average earnings in the region.

Tables 1-13, 1-14, and 1-15 provide 1961 and 1964 data from which several conclusions can be drawn to support the views of the Royal Commission.

1) There are proportionately fewer people of the usual working age of 20-64 in the Atlantic Provinces than elsewhere in Canada. Families of the Atlantic Provinces, especially in Newfoundland and New Brunswick, have more children, and therefore a smaller proportion of adults than families elsewhere in Canada.

2) Smaller proportions of males and females in the Atlantic Provinces work, that is, form part of the labour force, especially in Newfoundland. Jobs for females in the Atlantic Provinces tend to be more restricted than elsewhere to professions such as school teaching and nursing.

3) Of the males working for wages, smaller proportions in the Atlantic Provinces than elsewhere are employed on a regular basis.

4) Levels of salaries and wages are considerably lower in the Atlantic Provinces, especially in Prince Edward Island.

5) Total personal income per capita is lower in the Atlantic Provinces, being less than two-thirds that of Ontario in 1964.

6) Not only is earned income less in the Atlantic Provinces, but government transfer payments are no higher. Indeed, for Newfoundland, transfer payments per capita in 1964 were the lowest in Canada.

7) Even when the greater size of the Atlantic family is taken into account, personal income per household is still less than 80 per cent of the Canadian average, less than 70 per cent of Ontario.

TABLE 1-13

Characteristics of the Male Work Force, Provinces of Canada, 1961

Province	% of Population Aged 20-64	Male Labour Force as % of Males 20-64	% Male Wage Earners Regularly Employed*	Average Male Salaries & Wages
	%	%	%	$
Nfld.	42.7	86.8	55.1	2,823
P.E.I.	45.0	106.9	56.4	2,359
N.S.	47.9	99.5	69.0	3,021
N.B.	45.2	97.4	61.8	2,807
Qué.	49.9	99.2	69.6	3,469
Ont.	52.7	103.0	75.9	3,984
Man.	50.7	104.1	72.0	3,574
Sask.	48.8	106.4	67.3	3,290
Alta.	50.3	104.1	71.6	3,733
B.C.	51.7	98.8	70.5	4,004
Canada	50.6	101.2	71.7	3,679

* Regularly employed means at least 40 weeks annually, at least 35 hours weekly.

Source: Derived from Census of Canada, 1961. Subprovincial data are contained in Appendix Table A-3.

TABLE 1-14

Characteristics of the Female Work Force, Provinces of Canada, 1961

Province	Female Labour Force as % of Females 20-64	% Female Work Force in Professions	Annual Average Female Salaries and Wages
	%	%	$
Nfld.	25.3	19.8	1,446
P.E.I.	35.5	19.7	1,285
N.S.	33.6	20.3	1,607
N.B.	34.1	19.8	1,569
Qué.	36.2	n.a.	1,920
Ont.	42.4	n.a.	2,119
Man.	41.7	n.a.	1,902
Sask.	35.3	n.a.	1,974
Alta.	39.5	n.a.	2,001
B.C.	37.6	n.a.	2,096
Canada	38.6	15.4	1,995

Source: Derived from Census of Canada, 1961. Subprovincial data are contained in Appendix Table A-4.

TABLE 1-15

Personal Income Per Capita and Components, by Provinces, 1964

Province	Total Earned Income	Investment Income	Government Transfer Payments	Total Personal Income	Personal Income per Household
	$	$	$	$	$
Nfld.	829	59	187	1,065	5,300
P.E.I.	850	93	234	1,224	5,100
N.S.	988	125	213	1,362	5,400
N.B.	930	97	227	1,246	5,500
Qué.	1,256	159	215	1,608	6,800
Ont.	1,674	258	209	2,125	7,900
Man.	1,399	193	218	1,796	6,600
Sask.	1,327	155	221	1,683	6,100
Alta.	1,422	171	214	1,793	6,600
B.C.	1,631	232	254	2,079	7,100
Canada	1,423	195	216	1,821	7,100

Source: Derived from National Accounts Income and Expenditure, 1964, D.B.S., and from Census of Canada, 1961.

Emigration

People have been migrating from the Atlantic Provinces to other parts of Canada and to the United States for many years. (Howland, 1957.) Table 1-16 indicates that in the periods 1956-1961 and 1961-66, there was net emigration from each of the Atlantic Provinces, and from all but Newfoundland in 1951-56.

Moreover, there was net emigration from nine of Newfoundland's ten census divisions in 1956-1961 and from eight in 1961-66 (see Appendix Table A-5). Labrador, because of the development of iron mines, experienced a net immigration. During 1951-56 there was net emigration from five census divisions, but not from the divisions containing the major urban centres (St. John's, Corner Brook, Grand Falls), nor from Labrador nor the St. Barbe Peninsula. Prince Edward Island experienced a net emigration from each of her three counties in each five-year period. For Nova Scotia, during 1961-66 there was net emigration from all 18 counties; during 1956-1961 from all but Halifax county (containing the city of Halifax); and during 1951-56 from all but Halifax, Kings, and Colchester (containing Truro). Net emigra-

tion took place in each of the three periods from 10 of New Brunswick's 15 counties. The exceptions were Albert, Kings, and York counties for all three periods, and for Saint John and Sunbury for 1951-56 and 1956-1961. Sunbury contains the recently established military base at Oromocto, and the others are in the vicinity of New Brunswick's three major cities of Saint John, Moncton and Fredericton. Thus, except for certain areas, mostly urban, emigration was widespread throughout the Atlantic Provinces in each third of the 15-year period ending in 1966.

TABLE 1-16

Net Migration*, Atlantic Provinces, 1961-66, 1956-61, and 1951-56

Province	Net Emigration (-) or Immigration (+)		
	1961-66	1956-61	1951-56
	%	%	%
Newfoundland	-5.2	-3.9	+0.5‡
Prince Edward Island	-4.4	-3.3	-8.2
Nova Scotia	-5.5	-3.3	-1.7
New Brunswick	-5.7	-3.0	-4.0
Canada	+1.4	+3.0	+4.3

* Expressed as a percentage (plus or minus) of the population in the base year.

‡ Immediately after Confederation in 1949, there was a substantial movement into Newfoundland from mainland Canada of government and business officials, and their families.

Source: Appendix Table A-5.

Table 1-17 shows that population increases were lower proportionately in the Maritime Provinces than for Canada as a whole in the period 1961-66, and for every decade but one since Confederation. In several of these decades Prince Edward Island showed declines in population and the other provinces such low increases that one can infer that the amount of emigration must have been substantial. Moreover, in 1951-1961, the decade of highest population increase since Confederation for Nova Scotia and New Brunswick, there was, as has been shown above, substantial emigration. This suggests that in at least some other decades the rate of emigration must have been even more substantial.

Appendix Table A-6 indicates that, with few exceptions, the counties of the Maritimes reflect the population changes of their provinces. However, Halifax county (containing Halifax and surrounding metropolitan area) has shown consistently higher population increases since Confederation than the province. In New Brunswick, Gloucester has consistently been growing more rapidly than the province. Restigouche and Madawaska have begun to taper off. In recent years, as has already been noted, the counties containing Saint John, Moncton, and Fredericton and their satellite communities have tended to increase more rapidly than the New Brunswick average.

TABLE 1-17

Population Increases in the Atlantic Provinces, 1961-66, and by Decades, 1881-1961

Province	1871 -1881	1881 -1891	1891 -1901	1901 -1911	1911 -1921	1921 -1931	1931 -1941	1941 -1951	1951 -1961	1961 -1966
	%	%	%	%	%	%	%	%	%	%
Nfld.*	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	27	8
P.E.I.	16	n.a.	-5	-9	-5	-1	8	4	6	4
N.S.	14	2	2	7	6	-2	13	11	15	3
N.B.	12	n.a.	3	6	10	5	12	13	16	3
Canada	17	11	11	34	22	18	10	22	30	10

* No information available prior to 1951.

Source: Derived from Census of Canada.

Cultural Integrity

The Atlantic Provinces and Québec differ from the rest of Canada in that few people reside there who were not born there (Table 1-18). As extremes, 97 per cent of the people residing in Newfoundland in 1961 were born there, as opposed to 47 per cent of the people of British Columbia. With comparatively few strangers in their midst there would seem to be stronger tendencies in the five eastern provinces than in the five western provinces to maintain traditional ways of life.

Emigration, by increasing interaction with outsiders, at least indirectly, would tend to counteract the lack of immigration. Table 1-18 suggests that there are many former Maritimers elsewhere in Canada, although comparatively fewer Newfoundlanders. These two sets of data combine to suggest that for Newfoundland, almost as much as for Québec, social interaction is more within the province, less with other provinces, than is the case elsewhere in Canada.[1/] The increasing emigration noted in Table 1-16 suggests that the social insularity of Newfoundlanders may be breaking down.

However, one might expect, especially for areas in Newfoundland, that "proportion born in the province" would be related inversely to educational output.

TABLE 1-18

Distribution by Province of Population Born in Province of Residence, 1961 and 1951

Province	% of Province's Population Born There		% of Canadians Born in the Province Still Living There	
	1961	1951	1961	1951
	%	%	%	%
Newfoundland	97	98	89	89
Prince Edward Island	90	92	72	77
Nova Scotia	85	87	80	85
New Brunswick	87	89	79	84
Québec	88	90	95	94
Ontario	69	73	92	92
Manitoba	69	66	72	73
Saskatchewan	72	66	65	67
Alberta	59	56	82	81
British Columbia	47	40	90	91

Source: Derived from Census of Canada, 1961 and 1951.

1/ Data on emigration to the United States and other countries are required for a more complete picture.

2. DEMOGRAPHIC AND ECONOMIC VARIABLES RELATED TO EDUCATIONAL PRODUCTIVITY

In this section are reported the correlations that were found between some 20 variables regarded as inputs, and seven measures of educational output or productivity. Findings are summarized for each of the Atlantic Provinces, for these provinces taken together, and for Canada.

The Input Variables

Relationships of socioeconomic and demographic variables with educational achievement or productivity have been noted by many investigators. Accordingly, in the present study, a number of promising input variables were selected to see if the expected relationships would hold in the Atlantic Provinces. Scores on each of the 20 input variables, and on the seven output variables, were obtained for each county or census division in the Atlantic Provinces, and for each of the provinces of Canada.

Educational Deprivation

For each county or census division three measures were obtained of the educational deprivation of the area, the measures being calculated from data provided by the 1961 Census:

1) Per cent of the population five years of age and over, not attending school, who have no schooling (illiterate).

2) Per cent of the population five years of age and over, not attending school, who have no schooling or less than grade five (illiterate or functionally illiterate).

3) Per cent of the population with some university education, or with a university degree.

The notion here is that an environment of illiteracy or functional illiteracy will impede a child's educational progress, and, contrariwise, that in an area where there are more university-educated people a child's educational progress will be encouraged. The data are shown in Appendix Table A-7.

Proportion of Children in the Population

Previous studies have suggested negative relationships between size of family or similar variables and educational achievement. Three measures were used in the present study:

1) Children per family.

2) Persons per household.

3) Per cent of the population aged 20-64.

The first two, it was hypothesized, would relate negatively to educational output, the third positively. The data used are contained in Appendix Tables A-1 and A-3.

Proportion of Population Urban

City dwellers generally attain more years of schooling than village residents. Accordingly, educational output was expected to relate negatively to the first measure, positively to the second:

1) Per cent of the population classified as rural non-farm.

2) Per cent of the population in towns of 10,000 or more.

These data are contained in Appendix Table A-2.

Economic Variables

Six measures of the economic level of the county or census division were used, the hypothesis being that educational productivity would be affected by the area's economic level. Five of these correlations were expected to be positive, the sixth negative.

1) Per cent of the male work force in professions.

2) Average male salaries and wages.

3) Per cent male wage earners regularly employed.

4) Male labour force as a per cent of the male population aged 20-64.

5) Female labour force as a per cent of the female population aged 20-64.

6) Per cent male work force in primary industries.

These data are contained in Appendix Tables A-3, A-4 and A-8.

Additional Demographic Variables

Three additional demographic variables were considered worth testing:

1) Per cent of the population born in the province.

2) Per cent of the population who are Roman Catholic.

3) Per cent of the population who speak French only.

The first of these was used on the expectation that in the Atlantic Provinces people who were born in a province and still live there would engender in young people a complacency with their lot, thereby manifesting a negative relationship with educational output.

No hypotheses were established regarding the relationships between educational achievement and Roman Catholicism or French unilingualism. However, it was considered important to see if any relationships existed in the Atlantic Provinces.

The data used are contained in Appendix Tables A-9 and A-10.

Measures of Educational Input

Three measures of educational input were used, one expected to be positively related to educational output and the last two negatively related:

1) Per-pupil expenditure on teachers' salaries.

2) Per cent of all teachers who have two years training or less.

3) Per cent of elementary teachers with two years training or less.

These last three variables were not primarily of interest in themselves. Rather were they used as criteria of the importance of the other 17 variables. It was decided that, to be regarded as significant, the correlation between one of the 17 input variables and one of the output variables would have to be greater than any of the three correlations between the educational input variables and that educational output variable.

The data are contained in Appendix Table A-11.

The Output Variables

Seven measures of educational productivity or output were used. Two dealt with retention, two with completion, and three (negative measures) with pupils over-age in grade (retardation). Data are contained in Appendix Table A-12.

Retention

The two retention measures were devised by Cheal from data supplied by a special analysis carried out by the Education Division of the Dominion Bureau of Statistics:

1) Enrolment in Grade 11, 1965, as per cent of Grade 7, 1961 (adjusted for population change).

2) Enrolment in Grade 12, 1965, as per cent of Grade 8, 1961 (adjusted for population change).

These data could be obtained for New Brunswick, Nova Scotia, and Prince Edward Island. However, since Newfoundland has no Grade 12, it was necessary to use the crude measure "Enrolment in Grade 10, 1965 as per cent of Grade 6, 1961".

When correlations were calculated for the provinces of Canada, two new measures of retention had to be used: 1/

1) Per cent of age seven boys, 1952-53 reaching Grade 11 by 1964-65.

2) Per cent of age seven girls, 1952-53 reaching Grade 11 by 1964-65.

Completion

The two completion measures were also devised, and in a similar fashion to retention measures, by Cheal:

1) Pupils passing Grade 11, 1965 as per cent of Grade 7, 1961 (adjusted).

2) Pupils passing Grade 12, 1965 as per cent of Grade 8, 1961 (adjusted).

1/ Adapted from Dominion Bureau of Statistics, Student Progress Through the Schools, by Age and Grade 1965, Table 3. For Québec a combined figure was obtained by assuming Protestant enrolment at age seven to be 10.5 per cent of Catholic enrolment.

These data were obtainable for Nova Scotia and New Brunswick, and, on variable 1, for Newfoundland. For Newfoundland there was substituted for variable 2, "Pupils passing Grade 10, 1965 as per cent of Grade 6, 1961". No comparable data were available for Prince Edward Island.

For the provinces of Canada two similar completion measures were devised: 1/

1) Per cent of age seven boys, 1952-53, reaching Grade 12 (presumably having passed Grade 11).

2) Per cent of age seven girls, 1952-53, reaching Grade 12 (presumably having passed Grade 11).

Since these last data were unavailable for Newfoundland, that province was not included in the provinces of Canada completion analysis.

Retardation

Three measures of retardation were used, based on data supplied by Cheal from the special study by the Education Division of the Dominion Bureau of Statistics:

1) Per cent Grade 8 pupils one year or more over-age in grade, 1965.

2) Per cent Grade 7 pupils one year or more over-age in grade, 1965.

3) Per cent Grade 7 boys two years or more over-age in grade, 1965.

These data were available for all correlations.

Summary of Correlation Analysis

The matrixes showing the correlations between each variable and each of the other 26 input and output variables are contained in Appendix Tables A-13 through A-18. The Atlantic Provinces are considered separately and as a Region, and correlations are also examined for Canadian provinces. Highlights of the important findings are summarized below.

New Brunswick

Table 1-19 lists the rank order of input variables which were significantly related to measures of educational out-

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1/ Adapted from Student Progress ..., loc. cit.

TABLE 1-19

Rank Order of Input Variables Significantly Related to Measures of Educational Output, among New Brunswick Counties

	Rank Order on Measures of						
	Retention		Completion		Retardation		
	(1)	(2)	(1)	(2)	(1)	(2)	(3)
Educational Deprivation							
1. % population illiterate	5½	4	5	4	4	3	3
2. % illiterate or functionally illiterate	5½	5	5	5	3	2	2
3. % with university education	8	6	7	6	8	4	10
Proportion of Children in Population							
1. Children per family	3	3	3	3	5	9	6
2. Persons per household	2	2	5	1	2	6	5
3. % population 20-64	1	1	1	2	7	10	7
Proportion of Population Urban							
1. % rural non-farm	9	8					
2. % in towns of 10,000							
Economic Variables							
1. % male work force in professions	7		8	8			
2. Average male salaries and wages							
3. % male wage earners regularly employed					9	8	9
4. Male labour force as % males 20-64						5	8
5. Female labour force as % females 20-64	4	7	2	7			
6. % male work force in primary industries							
Additional Variables							
1. % population born in province							
2. % Roman Catholic					1	1	1
3. % speaking only French	10				6	7	4
Educational Inputs							
1. Per pupil exp. on teachers' salaries	11	9	9	9	10	11	11
2. % teachers with 2 years training or less							
3. % elementary teachers with 2 years training or less							

Source: Appendix Table A-13.

put among New Brunswick counties. Considering the output measure labelled Retention 1 (enrolment in Grade 11 in 1965 as a per cent of Grade 7 enrolment in 1961) it will be seen that per-pupil expenditures on teachers' salaries ranked 11th. The other two measures of educational input ranked even lower. What is important is that there were 10 input variables more closely related to retention than per-pupil expenditure on teachers' salaries. New Brunswick counties that have lower retention rates are characterized by smaller proportions of population in the age group 20-64 (the highest correlation of .63), by more persons per household, more children per family, where women tend not to form part of the labour force, where there are higher proportions of illiteracy and functional illiteracy, lower proportions of professionals and people with university education. Similar patterns can be seen in Table 1-19 with respect to the other measure of retention and the two measures of completion.

The data presented here suggest that the solutions to problems of retaining pupils to complete their high school education must go beyond raising teachers' salaries and insisting on more training for teachers, must go beyond raising wage rates and expanding secondary industry. Rather do the data suggest that the crux of the problem of low educational productivity in some New Brunswick counties has to do with large families steeped in illiteracy. To confirm this, Appendix Table A-13 displays correlations of .95 and higher between size of family in the county and the degree of illiteracy.

These same input variables underlie retardation, although there is also the suggestion from Table 1-19 that counties with higher proportions of Roman Catholics have relatively more pupils over-age in grade. This relationship is discussed further in the Newfoundland analysis below.

Newfoundland

Table 1-20 highlights the more significant findings for Newfoundland. As in New Brunswick, per-pupil expenditures on teachers' salaries, and proportion of teachers with two years training or less were found to be less highly related to educational output than were many of the demographic variables. Conspicuously, measures of educational deprivation were again found significantly related to retention, completion and retardation. Also, higher outputs were associated with the more urban census divisions,[1/] those having higher proportions of people living in towns exceeding 10,000, fewer in towns of 1,000 or less.

1/ These data were available for Newfoundland for provincial electoral districts only. Accordingly, formulas had to be devised by which conversions could be made to census divisions.

TABLE 1-20

Rank Order of Input Variables Significantly Related to Measures of Educational Output, among Newfoundland Census Divisions

	Rank Order on Measures of						
	Retention		Completion		Retardation		
	(1)	(2)	(1)	(2)	(1)	(2)	(3)
Educational Deprivation							
1. % population illiterate	1	1	2	1		1	3
2. % illiterate or functionally illiterate	2	5	1	4	10	4	
3. % with university education					5		
Proportion of Children in Population							
1. Children per family					1	5	
2. Persons per household					2	11	
3. % population aged 20-64		7					
Proportion of Population Urban							
1. % rural non-farm	4			6	7	6	
2. % in towns of 10,000	3	6		2		2	
Economic Variables							
1. % male work force in professions				9		8	
2. Average male salaries and wages					3		
3. % male wage earners regularly employed					6		
4. Male labour force as % males 20-64				7	11	9	
5. Female labour force as % females 20-64					4		
6. % male work force in primary industries						10	
Additional Variables							
1. % population born in province		3		8	9		2
2. % Roman Catholic	5	4		3		3	4
3. % speaking only French		2		5	8	7	1
Educational Inputs							
1. Per pupil expenditures on teachers' salaries		8			12		5
2. % teachers with 2 years training or less	6		3	10		12	
3. % elementary teachers with 2 years or less							

Source: Appendix Table A-14.

Contrary to the finding for New Brunswick, higher outputs were associated in Newfoundland with higher proportions of Roman Catholics in the division. That, for Newfoundland census divisions, the correlation between proportion Roman Catholic and proportion in towns of 10,000 or more was .73 suggests that Roman Catholicism is not the basic variable underlying differences in output.

In Newfoundland the crux of the lower productivity in some census divisions seems to be the illiterate and functionally illiterate environments provided by many of the smaller outports.

Nova Scotia

The significant findings for Nova Scotia are shown in Table 1-21. Few of the correlations were significant. For the first measure of output, no correlation exceeded the criterion .60. However, for the second output measure, both "children per family" and "per cent of population aged 20-64" were significant. A similar picture is obtained from an analysis of the measures of completion. Counties with higher proportions of Grade 8's surviving to pass Grade 12 are counties with fewer children per family, higher proportions of the population aged 20-64, and smaller proportions of the work force in primary industries. However all these correlations are small.

Retardation at Grade 8 presents no significant correlation, but both measures of retardation in Grade 7 are related to measures of educational deprivation, to smaller proportions of males and females in the labour force, and to larger proportions of the population born in the province.

Thus, the analysis for Nova Scotia presents no clear picture of the variables underlying differences in the educational output of various counties. There is, however, some suggestion that output is related negatively to size of family, illiteracy, and unemployment.

Prince Edward Island

Prince Edward Island has but three counties. Since correlations based on such a small number of measures are difficult to interpret, discussion has been omitted. The correlations are shown in Appendix Tables A-16 and A-17. Data for Prince Edward Island counties are, however, included in the Atlantic Region analysis which follows.

TABLE 1-21

Rank Order of Input Variables Significantly Related to Measures of Educational Output, among Nova Scotia Counties

	Rank Order on Measures of						
	Retention		Completion		Retardation		
	(1)	(2)	(1)	(2)	(1)	(2)	(3)
Educational Deprivation							
1. % population illiterate						5	3
2. % illiterate or functionally illiterate						3½	4
3. % with university education							
Proportion of Children in Population							
1. Children per family		2		3			
2. Persons per household							
3. % population aged 20-64		2		1			
Proportion of Population Urban							
1. % rural non-farm						2	
2. % in towns of 10,000						6	
Economic Variables							
1. % male work force in professions							
2. Average male salaries and wages							
3. % male wage earners regularly employed							
4. Male labour force as % males 20-64						3½	1
5. Female labour force as % females 20-64						7	2
6. % male work force in primary industries				2			
Additional Variables							
1. % population born in province						1	5
2. % Roman Catholic							
3. % speaking only French							
Educational Variables							
1. Per pupil expenditure on teachers' salaries	1	2	1	4	1	8	6
2. % teachers with 2 years training or less							
3. % elementary teachers with 2 years or less							

Source: Appendix Table A-15.

Atlantic Region

The important variables for all forty-five counties and census divisions of the Atlantic Provinces are identified in Table 1-22. Since comparative scores were not available for Newfoundland, no correlations were computed for Grade 12 retention and completion. Prince Edward Island counties do not form part of the correlation for Grade 11 completion.

For retention to Grade 11, the highest correlation was with measures of educational deprivation, namely with "per cent illiterate" and "per cent functionally illiterate". With a correlation of .64, differences in illiteracy account for some 40 per cent of the variance among counties and census divisions with respect to their retention of pupils from Grade 7 to Grade 11.

However, successful completion of Grade 11 correlates much less highly with the input variables. The highest is a negative correlation coefficient of .45 (about 20 per cent of the variance) with "per cent of male workers in primary industries". "Per cent of male work force in professions" correlates 41.

For differences in retardation rates, correlations are much higher with demographic and economic variables than with the three measures of educational input. Table 1-22 indicates the direct relationships between retardation and educational deprivation, children per family, "non-employment", irregular employment, and residence in communities of less than 1,000 people. Forty-six per cent of the variance (r = .68) between counties and census divisions with respect to retardation in Grade 7 is accounted for by the input variable "male labour force as a per cent of males aged 20-64".

Canada

Among the Provinces of Canada there are many high correlation coefficients between measures of educational output and the input variables used in this study. (See Appendix Table A-19.) Many of these correlations tend to be overlooked in Table 1-23 which identifies only those which exceed the criterion coefficient, in this case "per pupil expenditures on teachers' salaries".

Table 1-23 indicates that associated with low completion rates and low retention rates are provinces with more children per family, more persons per household. The chief finding, however, is that provinces with higher retention and completion rates but lower retardation rates are those with smaller proportions of people born in the province. In fact, the proportion of the variance accounted for by this input variable on the seven measures of output ranges from 54 per cent to 77 per cent. This reflects the finding from the raw data that, generally speaking, in going westward in Canada from province to province, education-

TABLE 1-22

Rank Order of Input Variables Significantly Related to Measures of Educational Output, among Atlantic Provinces Census Divisions and Counties

	Rank Order on Measures of						
	Retention		Completion		Retardation		
	(1)	(2)	(1)	(2)	(1)	(2)	(3)
Educational Deprivation							
1. % population illiterate	1					3½	3
2. % illiterate or functionally illiterate	2				3½	2	2
3. % with university education					3½	5	6
Proportion of Children in Population							
1. Children per family					2	6	4½
2. Persons per household					1	3½	4½
3. % population aged 20-64							
Proportion of Population Urban							
1. % rural non-farm							8
2. % in towns of 10,000							
Economic Variables							
1. % of male work force in professions			2				
2. Average male salaries and wages							
3. % male wage earners regularly employed						8½	9
4. Male labour force as % males 20-64						1	1
5. Female labour force as % females 20-64							
6. % male work force in primary industries			1				
Additional Variables							
1. % population born in province						7	
2. % Roman Catholic							
3. % speaking only French							7
Educational Variables							
1. Per pupil expenditure on teachers' salaries			3		5	8½	10
2. % teachers with 2 years training or less	3						
3. % elementary teachers with 2 years or less							

Source: Appendix Table A-18.

TABLE 1-23

Rank Order of Input Variables Significantly Related to Measures of Educational Output, among the Provinces of Canada

	Rank Order on Measures of						
	Retention		Completion		Retardation		
	(1)	(2)	(1)	(2)	(1)	(2)	(3)
Educational Deprivation							
1. % population illiterate							
2. % illiterate or functionally illiterate							
3. % with university education							
Proportion of Children in Population							
1. Children per family			2½	2			
2. Persons per household		2	1	1			
3. % population aged 20-64							
Proportion of Population Urban							
1. % rural non-farm							
2. % in towns of 10,000							
Economic Variables							
1. % of male work force in professions							
2. Average male salaries and wages							
3. % male wage earners regularly employed							
4. Male labour force as % males 20-64							
5. Female labour force as % females 20-64							
6. % male work force in primary industries							
Additional Variables							
1. % population born in province	1	1	2½	3		1	1
2. % Roman Catholic							
3. % speaking only French							
Educational Variables							
1. Per pupil expenditures on teachers' salaries	2	3	4	4	1	2	2
2. % teachers with 2 years training or less							
3. % elementary teachers with 2 years or less							

Source: Appendix Table A-19.

al output increases and the proportion of provincially-born people decreases.

The question of causal connection between educational output and proportion provincially born should not be dismissed summarily. Conceivably, the children of those who stay at home depend less on the school for socialization and status achievement than the children of migrants. Conceivably also, schools may have more to contribute during environmental change than during stability. As far as the Atlantic Provinces and their subdivisions are concerned, the extent to which lower educational output is a problem depends importantly upon the extent to which life in these areas will probably change and the extent to which people desire it to change.

3. SUMMARY

The foregoing analyses have shown that the educational patterns of retention, completion, and retardation, are linked importantly with the social and economic patterns of the Atlantic Provinces. If retention rates and completion rates are judged to be undesirably low, and retardation rates undesirably high, it would seem that proposals for amelioration must somehow be able to counteract the influences on school children and pre-school children of adult illiteracy in the home, in the extended family, and in the community. Also requiring consideration are the questions of family size, non-employment, and residence in small communities. It seems that the educational problems of the Atlantic Provinces are rooted importantly in the culture and the family structure of the region. Those charged with planning educational arrangements of the Atlantic Provinces or in specific counties or census divisions therein, must, therefore, consider the culture, the values, and the social structure of the area. The data here suggest that a program restricted to increasing educational expenditures along traditional lines is apt to be ineffective.

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PROFILES OF EDUCATION
in the
ATLANTIC PROVINCES

PART TWO

INTERPROVINCIAL DIFFERENCES
IN ELEMENTARY AND
SECONDARY EDUCATION

PART TWO

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PART TWO

INTERPROVINCIAL DIFFERENCES IN ELEMENTARY AND SECONDARY EDUCATION

1. INTRODUCTION

Section 93 of the British North America Act contains two basic provisions which have had far-reaching consequences for the development of education in Canada during the past century. It was recognized in 1867 that these provisions were not ideal solutions but necessary compromises in order that Confederation might be accomplished. They have historical roots which go back a century and a half before the union (Cheal, 1963). These two provisions are:

1) The provinces have exclusive legislative authority respecting education.

2) In any province, legal rights to denominational schools which existed at the time of entering the union are protected.

The outgrowth of these provisions has been the evolution of 10 distinctive systems of education in Canada. The following are some of the major consequences of this development:

1) There is no federal office of education in Canada.

2) Federal participation in education has been largely confined to the field of post-secondary education.

3) No central agency except D.B.S. exists, on either a national or regional basis, to collect and disseminate information about education and to promote research and development in areas of general concern.

4) No national policies regarding elementary and secondary education have been developed.

5) A strong department of education exists in each province.

6) Each province has worked out its own pattern of local district organization and responsibility.

7) Each province has evolved its own pupil organization, curriculum, and examinations.

8) Each province has developed its own program and standards of teacher preparation and certification.

9) The denominational provision has differential effects among provinces in regard to the distribution of pupil enrolments and financial support.

While the inputs of the 10 educational systems, and the quality of the interaction among them, are largely determined by factors of a provincial nature, the output in terms of social and economic abilities is of concern beyond the province. The relative contribution which each provincial educational system makes toward meeting national manpower requirements is of particular interest to economic planners. While recognizing the uniqueness of each provincial system its comparison with other provincial systems is perhaps useful and unavoidable.

In this part of the study the major characteristics of the school systems of the Atlantic Provinces are compared with those of the four Western Provinces on both a regional and an interprovincial basis. The purpose of this comparison is to provide some frame of reference within which the inputs and outputs of education in the Atlantic Region may be evaluated. It is not, however, intended that the Western Provinces, either collectively or individually, should serve as models. Major improvements are continually being made in all systems, and all would disclaim having achieved their goals. For several reasons comparisons have not been made with the educational systems in the provinces of Ontario and Québec. Due to the high degree of industrialization and urbanization in these provinces, together with the size of population, comparisons might not be too meaningful. The degree of complexity in the school systems of the two central provinces is another reason for excluding them from the comparisons. In some cases national averages are given, however.

Section 2 is concerned with differences in inputs between and among the provinces of the Atlantic and Western Regions with respect to elementary and secondary education. The pupil input is analysed in terms of education need and education load, and the teacher input in terms of supply and distribution, and qualifications and salaries. Total expenditures on education are reported and their relationship to financial ability is discussed. Sizes of schools and school districts as factors affecting interaction among input variables are given general consideration.

Differences in educational outputs among the provinces of the two regions are the subject of analysis in Section 3. The chief output measure which can be used on an interprovincial basis is pupil retention rate. Some reference is also made to retardation rates as a factor related to pupil retention. Section 4 gives a summary of the findings of this Part of the report.

2. INTERPROVINCIAL DIFFERENCES IN EDUCATION INPUTS

This section examines on an interprovincial and interregional basis four categories of inputs of provincial education systems: pupils, teachers, expenditures and school organization. School organization is not so much an input as a factor determining the distribution and interaction of inputs. Because of this relationship it is reported in this chapter. Pupil input is discussed in terms of education need and education load; teacher input, in terms of distribution and qualifications. Expenditures are analysed on the basis of teacher salaries and operating expenditures. Sizes of schools and school districts are the variables considered under school organization.

Education Need

The term "education need" is used to describe the potential number of students for whom educational opportunities might be provided at each level of the education system. It is distinguished from the number of pupils actually enrolled in the system, which is described by the term "education load".

> "Education needs" is not an unambiguous term. There is no such thing as a "need" for education (either by an individual or a society) except in terms of the values and goals that happen to be held and the total amount of resources available for the pursuit of those goals. A country's "needs" for education, in other words, depend upon the criteria selected and even then can be ascertained only in reference to a host of competing needs. (Parnes, 1962: p. 12.)

The criteria for determining education need for the purposes of this study may be found in the educational goals already outlined. Broadly stated, "education need" in a technologically developed and democratically governed society refers to the formal and informal requirements necessary to fully develop the social and economic abilities of each individual. This, of course, assumes that relatively unlimited resources are available and could be allocated. Operationally defined, "education need" is used in this section of the study to mean the provision of suitable education programs and facilities for all young people from the age of 5 to 19, inclusive. This broad age range would include almost all pupils who enrol in the elementary and secondary schools of the several provincial systems and would also accommodate the age groupings used in census data.

As thus defined, education need is directly related to patterns of population growth and distribution. It is determined by such factors as birth rates, family size, age distribution, immigration, interprovincial migration, and rural-urban trends.

The pattern of population growth for the Atlantic and Western Regions during the period from 1951 to 1966 is given in Table 2-1, and illustrated in Figure 2-1. By 1966 the population of the Atlantic Region had reached almost 2 million, and that of the Western Region 5¼ million. This total for the Atlantic Provinces involved an increase of more than 350,000 during the 15-year period. However, the percentage increase for each of the five-year census periods which it included had been steadily decreasing. The percentage increase for 1961-66 was less than half that for 1951-56. The decline in growth rate was greatest in Nova Scotia where an increase of 8.1 per cent in 1951-56 had been reduced to an increase of 2.6 per cent by 1961-66. The Western Provinces also showed a declining rate of increase for each of the five-year periods.

The distribution of population by age groups is also illustrated in Figure 2-1. The 0-4 age group, which had a small increase from 1951 to 1956, and again from 1956 to 1961, experienced a decrease from 1961 to 1966. The data in Table 2-2 show that there were 11,203 fewer children in the 0-4 age group in the Atlantic Provinces in 1966 than there were in 1961, a decrease of 5 per cent. This age group increased by 4,276 children, or only 0.7 per cent in the Western Provinces. The reduction in this age group in Nova Scotia amounted to 5,718 children or 6 per cent, in New Brunswick to 5,701 children, or 7 per cent. Newfoundland was the only province in the Atlantic Region to have a slight increase in the population of the 0-4 age group.

The population increase of the 5-9 age group in the Atlantic Region was about 6,500, or 3 per cent from 1961 to 1966. It should be noted, however, that five years before, in 1961, there were 250,615 children in the 0-4 age group compared with 243,758 in the same cohort in 1966, a decrease of 7,000. In the Western Region the 5-9 age group increased by 60,000 or 11 per cent during this period, which represented 10,000 children more than the number reported in the 0-4 age group in 1961.

The changing population patterns of the Atlantic Provinces are illustrated in Figures 2-2 and 2-3. The per cent change in population from 1951 to 1961, by single years of age, is shown in Figure 2-2. Also indicated is the per cent change from 1961 to 1966. During the earlier decade the greatest per cent increase occurred in the 9-16 group with the peak at age 12. In 1968 this age cohort would be found already in, or about to enter, institutions of higher and post-secondary education or the labour force. Those pupils who were age 12 in 1961 would be graduating from high school if they had continued to attend and had progressed at a normal rate. It is highly probable, however, that less than half would still be found in school in 1968, and these would be distributed over several high school grades.

The lowest percentage increase during the 1951-1961 decade occurred at the four-year age level. Children in the 4-9 age group in 1961 would be represented in the 9-14 category in

TABLE 2-1

Population Growth, 1951-1966

Province or Region	Population				Per Cent Change				
	1951	1956	1961	1966	51-56	56-61	61-66	51-61	56-66
Newfoundland	361,416	415,074	457,853	493,396	14.8	10.3	7.8	26.7	18.9
Prince Edward Island	98,429	99,285	104,629	108,535	0.9	5.4	3.7	6.3	9.3
Nova Scotia	642,584	694,717	737,007	756,039	8.1	6.1	2.6	14.7	8.8
New Brunswick	515,697	554,616	597,936	616,788	7.5	7.8	3.2	15.9	11.2
Atlantic Region	1,618,126	1,763,692	1,897,425	1,974,758	9.0	7.6	4.1	17.3	12.0
Manitoba	776,541	850,040	921,686	963,066	9.5	8.4	4.5	18.7	13.3
Saskatchewan	831,728	880,665	925,181	955,344	5.9	5.1	3.3	11.2	8.5
Alberta	939,501	1,123,116	1,331,941	1,463,203	19.5	18.6	9.9	41.8	30.3
British Columbia	1,165,210	1,398,464	1,629,082	1,873,674	20.0	16.5	15.0	39.8	34.0
Western Region	3,712,980	4,252,285	4,807,893	5,255,287	14.5	13.1	9.3	29.5	23.6

Source: Derived from Census of Canada, 1961 and 1966.

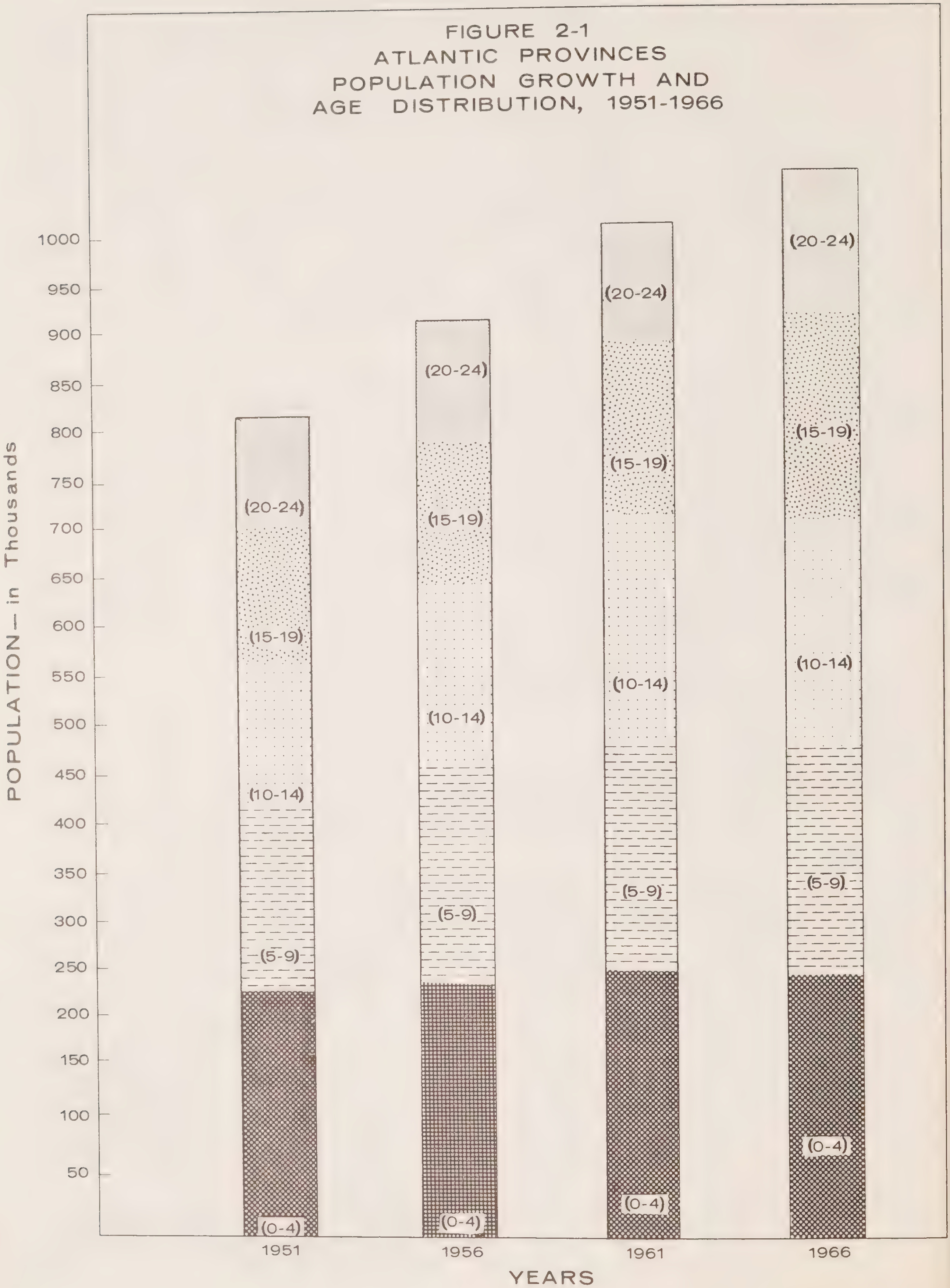


FIGURE 2-1
ATLANTIC PROVINCES
POPULATION GROWTH AND
AGE DISTRIBUTION, 1951-1966
POPULATION — in Thousands
1000
950
900
850
800
750
700
650
600
550
500
450
400
350
300
250
200
150
100
50
(20-24)
(15-19)
(10-14)
(5-9)
(0-4)
1951
1956
1961
1966
YEARS

TABLE 2-2

Population Change by Age Groups, 1961-66

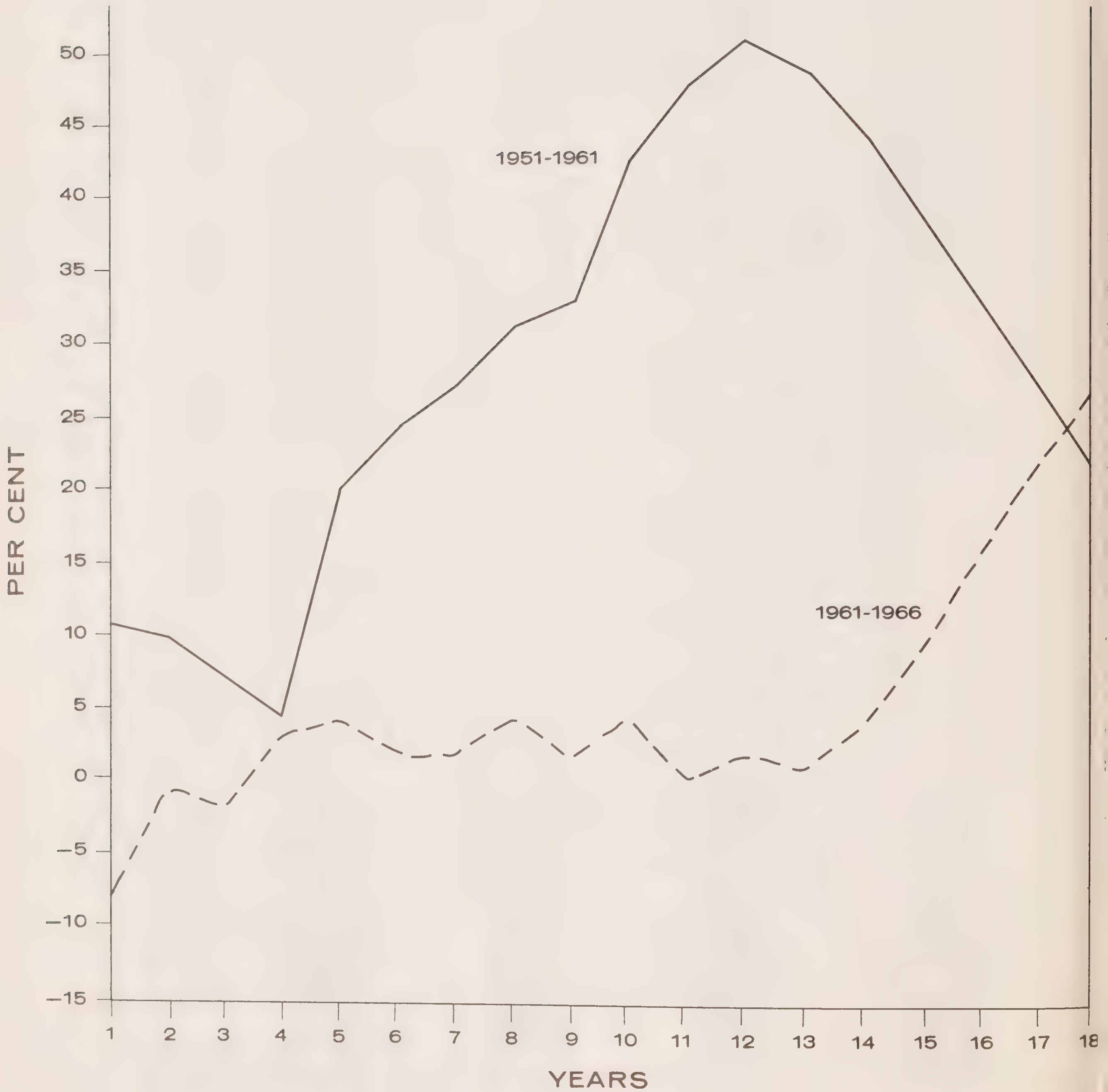
	Newfoundland				Prince Edward Island				Nova Scotia			
Age Group	1961	1966	Change No.	Change %	1961	1966	Change No.	Change %	1961	1966	Change No.	Change %
0-4	67,695	68,545	850	1.3	13,221	12,587	-634	-4.8	91,239	85,521	-5,718	-6.3
5-9	64,404	67,007	2,603	4.0	12,216	13,023	807	6.6	84,760	87,433	2,673	3.2
10-14	59,464	63,531	4,067	6.8	12,264	12,023	-241	-2.0	80,329	81,600	1,271	1.6
15-19	43,829	54,307	10,478	23.9	8,875	11,061	2,186	24.6	64,239	74,142	9,903	15.4
20-24	30,238	35,976	5,738	19.0	6,344	6,781	437	6.9	49,311	52,598	3,287	6.7
5-14	123,868	130,538	6,670	5.4	24,480	25,046	566	2.3	165,089	169,033	3,944	2.4
5-19	167,697	184,845	17,148	10.2	33,355	36,107	2,752	8.3	229,328	243,175	13,847	6.0

	New Brunswick				Atlantic Region				Western Region			
Age Group	1961	1966	Change No.	Change %	1961	1966	Change No.	Change %	1961	1966	Change No.	Change %
0-4	78,560	72,859	-5,701	-7.3	250,715	239,512	-11,203	-4.5	588,010	592,286	4,276	0.7
5-9	75,882	76,295	413	0.5	237,262	243,758	6,496	2.7	538,982	598,265	59,283	11.0
10-14	72,745	72,908	163	0.2	224,852	230,062	5,260	2.3	466,495	542,613	76,118	16.3
15-19	53,514	65,567	12,053	22.5	170,457	205,077	34,620	20.3	355,329	463,665	108,336	30.5
20-24	37,419	42,331	4,912	1.3	123,312	137,686	14,374	11.7	300,329	360,815	60,486	20.1
5-14	148,627	149,203	576	0.4	462,064	473,820	11,756	2.5	1,005,477	1,140,878	135,401	13.5
5-19	202,141	214,770	12,629	6.2	632-521	678,897	46,376	7.3	1,360,806	1,604,543	243,737	17.9

Source: Census of Canada, 1961 and 1966.

FIGURE 2-2

Atlantic Provinces Per Cent Change
in Population by Single Years of Age
1951-1961 and 1961-1966



1966. The graph for the 1961-66 period shows a low point at age 11 and indicates a general levelling off throughout the 10-year span from age 4 to 14. The graph also indicates a further drop of some 15 percentage points for the youngest group, age 1 to 3. This pattern of declining population growth is illustrated for each of the Atlantic Provinces in Figure 2-3.

The implications for education need of this population picture are clear. The postwar peak has now passed through the secondary schools and moved on into the tertiary systems of education or into the labour force. For the next seven or eight years educational need at the secondary level may be expected to remain fairly constant at a point considerably below the peak of the past few years. Following this eight-year period a further decline in level of need may be anticipated. Meanwhile the level of need for elementary education may be expected to fall off sharply within the next few years.

In Table 2-3 will be found the estimated net change in the 5-17 population which may be attributed to migration during the period 1961-64. A slight outmigration is indicated for the Atlantic Region and a small inmigration for the Western Region. The highest rate of outmigration in the Atlantic Region occurred in New Brunswick - 1.7 per cent. Saskatchewan had an outmigration for the 5-17 age group of 2.7 per cent, the highest in the Western Region. In the Atlantic Provinces it would appear that migration contributed only a small proportion of the change in population for the 5-17 age group from 1961 to 1964. Lower birth rates must account for the remainder.

Another form of migration having implications for education need on a subprovincial basis is that from rural to urban areas. Table 2-4 gives the per cent distribution of population between rural and urban areas for each of the provinces in the two regions in the years 1956, 1961 and 1966. In the period from 1961 to 1966 an increase of 12 per cent in the urban population resulted in 53.6 per cent of the total population of the Atlantic Region being classified as urban and 46.4 per cent as rural. In the Western Region, during this period, urban population increased by 17.3 per cent to become 67.2 per cent of the total, leaving the rural population at 32.8 per cent.

In the Atlantic Region, both rural farm and nonfarm populations declined substantially relative to the total population. In 1956 the rural farm population represented 15.5 per cent of the total, in 1966 it was only 6.9 per cent. The nonfarm population had been 35.2 per cent in 1956, increased to 41.6 per cent in 1961 and declined to 39.5 per cent in 1966. From 1961 to 1966, while the urban population of the Atlantic Region increased by 12 per cent, the total population increased by only 4.1 per cent. In Newfoundland the rate of urban growth was double the provincial rate, in Nova Scotia three times, in New Brunswick four times, and in Prince Edward Island nearly five times the provincial rate.

FIGURE 2-3

Per Cent Change in Population by Single Years of Age, by Province, 1961-66

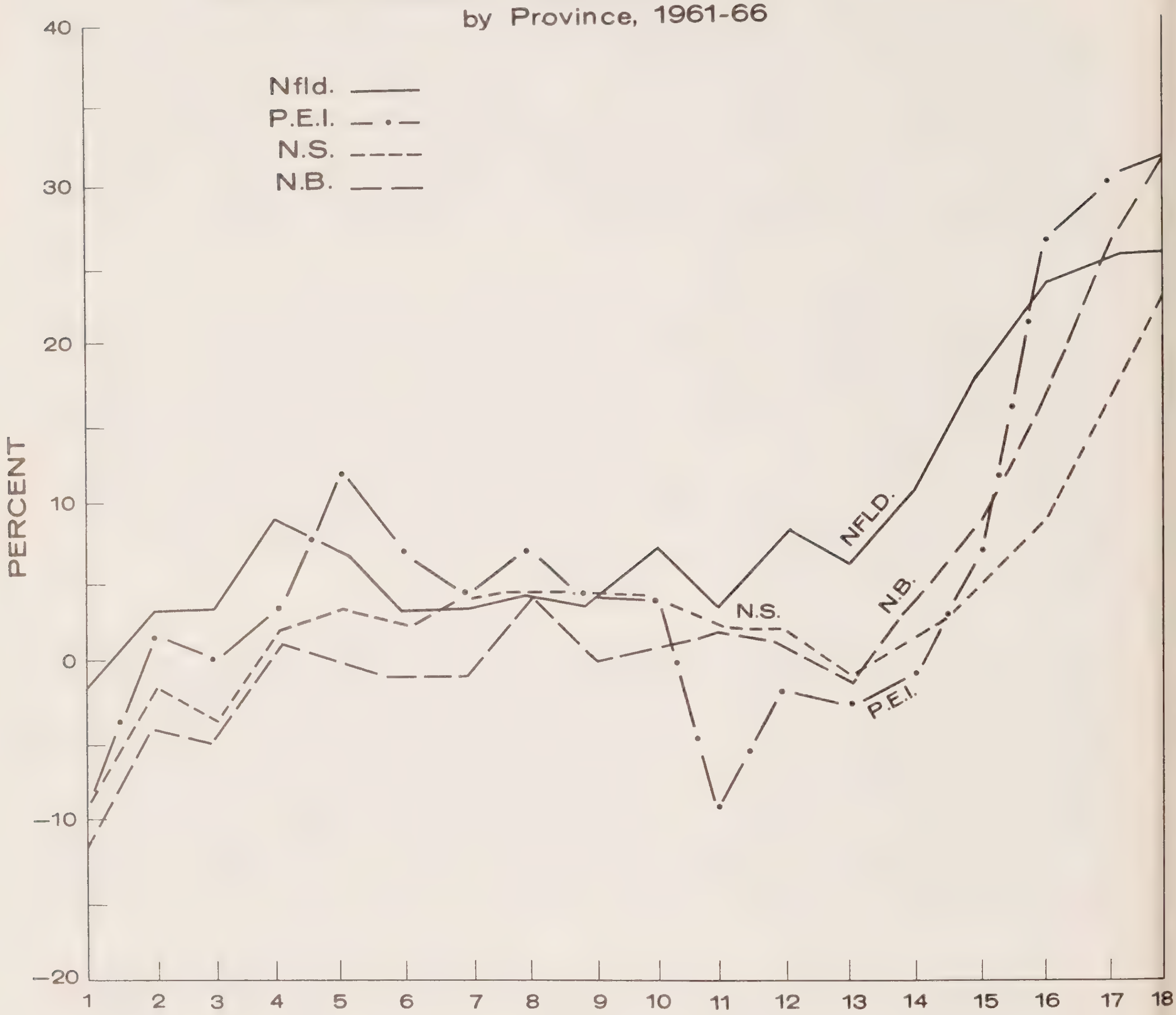


TABLE 2-3

Estimated Net Change in Numbers Due to Migration, Single Years 5-17, 1961-64

Age	Nfld.	P.E.I.	N.S.	N.B.	Atl.	Man.	Sask.	Alta.	B.C.	West.
5	-56	-37	-233	-212	-538	-164	-434	+182	+473	+57
6	-56	-36	-231	-205	-528	-162	-430	+176	+485	+69
7	-56	-38	-236	-204	-534	-157	-435	+166	+485	+59
8	-53	-34	-240	-208	-535	-157	-436	+157	+507	+71
9	-54	-35	-240	-212	-541	-161	-444	+144	+530	+69
10	-69	-35	-270	-237	-611	-162	-496	+149	+551	+42
11	-70	-31	-272	-235	-608	-164	-494	+137	+550	+29
12	-72	-33	-274	-255	-614	-161	-493	+138	+557	+40
13	-75	-31	-272	-233	-611	-164	-494	+136	+560	+38
14	-75	-31	-276	-235	-617	-162	-488	+142	+570	+62
15	-76	-35	-304	-281	-696	-165	-630	+201	+638	+44
16	-78	-36	-309	-293	-720	-169	-635	+204	+677	+77
17	-81	-41	-323	-308	-753	-175	-651	+199	+720	+93
Total	-871	-453	-3,480	-3,110	-7,906	-2,123	-6,560	+2,141	+7,303	+750
% of 1961	-0.6	-1.5	-1.2	-1.7	-1.4	-0.9	-2.7	+0.6	+2.5	+0.01

Source: D.B.S. Student Progress Through the Schools, 1965, p. 10.

TABLE 2-4

Per Cent of Population Rural and Urban, 1956, 1961, 1966

	Nfld.			P.E.I.			N.S.			N.B.			Atl. Reg.		
	'56	'61	'66	'56	'61	'66	'56	'61	'66	'56	'61	'66	'56	'61	'66
Total Rural	55.5	49.3	45.9	69.3	67.6	63.4	42.6	45.7	41.9	54.2	53.5	49.4	50.7	50.2	46.4
Farm	2.4	2.0	1.7	43.4	33.0	28.4	13.7	7.7	5.9	22.5	10.4	8.4	15.5	8.6	6.9
Nonfarm	53.1	47.3	44.2	25.9	34.6	35.0	28.9	38.0	36.0	31.7	43.1	41.0	35.2	41.6	39.5
Total Urban	44.5	50.7	54.1	30.7	32.4	36.6	57.4	54.3	58.1	45.8	46.5	50.6	49.3	49.8	53.6
100,000+	-	-	-	-	-	-	39.2	37.5	38.9	-	-	-	15.5	14.6	14.9
30'-99,999	18.8	18.6	18.8	-	-	-	-	-	-	24.5	22.7	28.5	12.1	11.7	13.6
10'-29,999	5.6	10.5	5.5	16.8	17.5	33.2	3.2	6.7	6.7	5.5	10.3	8.8	5.3	9.3	8.5
Under 10,000	20.1	21.6	29.8	13.9	14.9	3.4	15.0	10.1	12.4	15.8	13.5	13.3	16.4	14.2	16.6

	Man.			Sask.			Alta.			B.C.			West. Reg.		
	'56	'61	'66	'56	'61	'66	'56	'61	'66	'56	'61	'66	'56	'61	'66
Total Rural	39.9	36.1	32.9	63.4	57.0	51.0	43.4	36.7	31.2	26.6	27.4	24.7	41.3	37.4	32.8
Farm	23.8	18.6	16.6	40.1	32.9	29.3	29.1	21.5	19.0	6.8	4.8	4.5	23.2	17.5	15.3
Nonfarm	16.1	17.5	16.3	23.3	24.1	21.7	14.3	15.2	12.2	19.8	22.6	20.2	18.1	19.9	17.5
Total Urban	60.1	63.9	67.1	36.6	43.0	49.0	56.6	62.3	68.8	73.4	72.6	75.3	58.7	62.6	67.2
100,000+	48.1	50.5	51.9	-	12.1	25.9	40.2	45.4	48.6	56.5	53.3	52.7	38.8	42.7	46.6
30'-99,999	-	-	-	18.5	13.9	3.5	-	2.5	2.5	-	-	-	3.8	3.4	1.3
10'-29,999	5.4	5.5	5.5	6.9	5.2	7.3	5.6	3.3	4.3	4.8	9.4	10.7	5.6	6.2	7.3
Under 10,000	6.6	7.9	9.7	11.1	11.8	12.3	10.8	11.1	13.4	12.1	19.9	11.9	10.5	10.3	12.0

Source: Derived from Census of Canada, 1956, 1961 and 1966.

The relative changes in the rural and urban population during the 1956-1966 decade are given on an age-group basis in Table 2-5. For each province and region the percentage change for the decade is given for the working-age group, the total school-age group, and the elementary and secondary groups separately. In the Atlantic Region the total school-age group increased by 22.2 per cent, while the working-age group increased by 7.6 per cent. The percentage increase for the 5-19 group in rural areas was 10.3 per cent while the increase in urban areas was 36.0 per cent. The working-age group had decreased by nearly 2 per cent in the rural areas and increased 15.8 per cent in the urban areas. The high school group had a total increase of 39.3 per cent in the Atlantic Region compared with 16.0 per cent for the elementary-age group. In each case, the urban increase was substantially greater than the rural increase.

Among the Atlantic Provinces Newfoundland had the greatest increase in both school-age groups, with urban centres again showing a much higher rate of growth. The working-age group in this province increased in urban centres at only half the rate of the school-age population. In rural areas there was a decline of 8.5 per cent in the working-age population.

Nova Scotia and New Brunswick had population increases of approximately the same magnitude for the 15-19 age group, and almost the same for the 5-14 age group. The percentage increase in urban population was much greater in New Brunswick than in Nova Scotia for both the school-age population and the working-age population. A 4.7-per-cent increase in the 20-64 working-age population in Nova Scotia had to support an 18.1-per-cent increase in the school-age population. In New Brunswick an increase of 7.6 per cent in the working-age population had to support a 20.6-per-cent increase in the school-age population.

In 1961 the school-age population comprised 32.0 per cent of the total population of the Atlantic Region, 25.9 per cent of the Western Region. In 1966 the school-age population constituted 46.5 per cent of the total population in the Atlantic Region and 41.4 in the Western Region. Indications are that education need will continue to increase at substantial rates in urban centres, even with a decline in birth rates, if the pattern of rural-urban migration continues. In rural areas, on the other hand, education need would be expected to fall off rather sharply as a result of both migration and lower birth rates.

Comparisons have been made of the relationship between the growth of the school-age population and that of the working-age population. Since the latter group must support the former, this relationship must enter into measures of education need. Table 2-6 gives the average number of children per family in each of the provinces for the years 1951, 1956 and 1961. The average continued to rise for each province during the three five-year periods. Statistics for 1966 indicate that a reversal of this trend will have set in. In 1961 the average number of children

TABLE 2-5

Per Cent Change in Population by Age Group,
Rural and Urban, 1956-1966

Age Group	Nfld.	P.E.I.	N.S.	N.B.	Atl.	Man.	Sask.	Alta.	B.C.	West.
5-14										
Total	23.7	12.1	13.0	13.9	16.0	24.9	20.5	51.1	54.8	40.3
Rural	3.8	1.3	9.3	3.7	5.3	0.6	-2.8	3.9	43.0	8.9
Urban	50.3	41.3	16.0	28.8	28.8	46.3	71.0	97.2	60.0	68.5
15-19										
Total	52.3	35.1	31.6	39.4	39.3	45.4	29.3	60.3	83.3	56.8
Rural	28.5	25.0	24.2	22.5	24.8	8.1	2.5	8.2	53.9	15.0
Urban	80.7	58.3	37.4	62.8	55.4	78.3	82.8	112.2	96.6	94.8
5-19										
Total	30.9	18.2	18.1	20.6	22.2	30.4	22.9	53.5	62.1	44.7
Rural	9.9	7.4	13.3	8.6	10.3	2.6	-1.4	5.0	45.8	10.6
Urban	58.4	46.2	22.0	38.0	36.0	55.0	74.4	101.1	69.4	75.5
20-64										
Total	13.5	4.4	4.7	7.6	7.6	6.8	2.3	22.3	27.4	16.9
Rural	-8.5	-5.2	3.9	-1.2	-1.6	-12.0	-17.4	-11.7	18.4	-7.0
Urban	39.0	23.7	5.2	16.3	15.8	17.5	33.4	45.6	30.4	31.9

Source: Derived from Census of Canada, 1956 and 1966.

TABLE 2-6

Average Number of Children per Family

Province or Region	1951	1956	1961
Newfoundland	2.37	2.56	2.67
Prince Edward Island	1.99	2.06	2.16
Nova Scotia	1.84	1.90	1.98
New Brunswick	2.09	2.21	2.28
Atlantic	2.04	2.15	2.24
Manitoba	1.53	1.62	1.74
Saskatchewan	1.71	1.75	1.83
Alberta	1.65	1.73	1.85
British Columbia	1.29	1.43	1.59
Western	1.52	1.61	1.74

Source: Census of Canada, 1951, 1956 and 1961.

per family in the Atlantic Region was 2.24 compared with 1.74 for the Western Region. Newfoundland had the highest average, followed by New Brunswick; British Columbia had the lowest. These data indicate that the level of education need would be higher in the Atlantic Provinces than in the Western Provinces, and highest in the provinces of Newfoundland and New Brunswick.

For the purpose of making comparisons of education need among provinces and regions an index of need has been developed and is presented in Table 2-7, column (a). This index takes into consideration the relationship between the school-age population and the supporting working-age population and also recognizes the higher costs of secondary education. It is derived by giving a weighting of 1.6 to the population in the 15-19 age group and expressing the resulting 5-19 population as a ratio of the 20-64 population. The weighting was derived from a consideration of the differences in median salaries of elementary and secondary teachers with some additional adjustment for smaller class size. (See Cheal, 1963: p. 73-74.)

In 1965 the need index for the Atlantic Region was found to be .88 compared with a .71 for the Western Region. Newfoundland had the highest index of 1.02, British Columbia the lowest of .65. These indexes would imply that the working-age population of the Atlantic Region would have to make a greater financial effort than that of the Western Region to meet its education need. The effort in Newfoundland would have to be more than 50 per cent greater than that of British Columbia. This factor relates directly to expenditures on education and ability to support education.

Education Load

The number of students enrolled in a school system, and taking advantage of the educational opportunities it offers, constitutes its education load. An index of education load may be derived by expressing the enrolment of young people in the 5-19 age group as a ratio of the working-age group of 20-64. As with the index of need, the enrolment figure for the 15-19 age group was weighted by a 1.6 factor. In Table 2-7, column (b), the index of education load is given for each province of the Atlantic and Western Regions for the year 1965. The index for the Atlantic Region was .66, for the Western Region .52. Newfoundland had the highest load index (.76) and British Columbia the lowest (.49). The provinces ranked in the same order on this index as on the need index.

From 1956 to 1966 the total school enrolment of the Atlantic Region increased by 32.1 per cent, and that of the Western Region by 53.3 per cent. In 1966, 27 per cent of the total population of the Atlantic Provinces was in elementary and secondary schools, compared with 23 per cent in 1956. In the Western Provinces 23 per cent of the total population was in school in

TABLE 2-7

Indexes of Education Need and Load,* 1965

Province or Region	(a) Need Index	(b) Load Index	(c) Enrolment Index	(d) 15-19 In School
Newfoundland	1.02	0.76	0.75	0.46
Prince Edward Island	0.87	0.64	0.74	0.50
Nova Scotia	0.79	0.61	0.78	0.53
New Brunswick	0.90	0.66	0.73	0.51
Atlantic	0.88	0.66	0.75	0.51
Manitoba	0.71	0.51	0.72	0.54
Saskatchewan	0.76	0.57	0.75	0.54
Alberta	0.74	0.55	0.74	0.54
British Columbia	0.65	0.49	0.75	0.66
Western	0.71	0.52	0.74	0.58

* Based upon population estimates.

Need Index: Population 5-19 as a ratio of population 20-64, with 15-19 weighted 1.6.

Load Index: School enrolment 5-19 as a ratio of population 20-64, with 15-19 weighted 1.6.

Enrolment Index: School enrolment 5-19 as a ratio of population 5-19, with 15-19 weighted 1.6.

15-19 in School: enrolment 15-19 as a ratio of population 15-19.

TABLE 2-8

Public School Enrolments, 1955-56, 1965-66

Province or Region	1955-1956				1965-1966				Per Cent Increase 1956-1966		
	Total	Sec.	Elem.	Sec.	Total	Sec.	Elem.	Sec.	Total	Sec.	Elem.
	no.	no.	no.	%	no.	no.	no.	%	%	%	%
Newfoundland	102,633	12,044	90,589	11.7	145,638	24,874	120,764	17.1	41.9	106.5	33.3
Prince Edward Island	21,499	3,555	17,944	16.5	27,854	6,354	21,500	22.8	29.6	78.7	19.8
Nova Scotia	156,847	23,624	133,223	15.1	199,856	41,664	158,192	20.8	27.4	76.4	18.7
New Brunswick	127,134	17,871	109,263	14.1	165,700	37,200	128,500	22.5	30.3	168.2	17.6
Atlantic Region	408,113	57,094	351,019	14.0	539,048	110,092	428,956	20.4	32.1	92.8	22.2
Manitoba	160,171	27,889	132,282	17.4	222,129	56,673	165,456	25.5	38.7	103.2	25.1
Saskatchewan	181,152	36,530	144,622	20.2	238,320	60,843	177,477	25.5	31.6	66.6	22.7
Alberta	223,949	45,055	178,894	20.1	362,159	92,469	269,690	25.5	61.7	105.2	50.8
British Columbia	241,477	51,991	189,486	21.5	414,376	106,460	307,916	25.7	71.6	104.8	62.5
Western Region	806,749	161,465	645,284	20.0	1,236,984	316,445	920,539	25.6	53.3	96.0	42.7

Source: D.B.S. Preliminary Statistics of Education, 1955-56, 1965-66.

FIGURE 2-4

PER CENT CHANGE IN PUBLIC SCHOOL ENROLMENT 1956-1965 BY GRADES, ATLANTIC AND WESTERN REGIONS

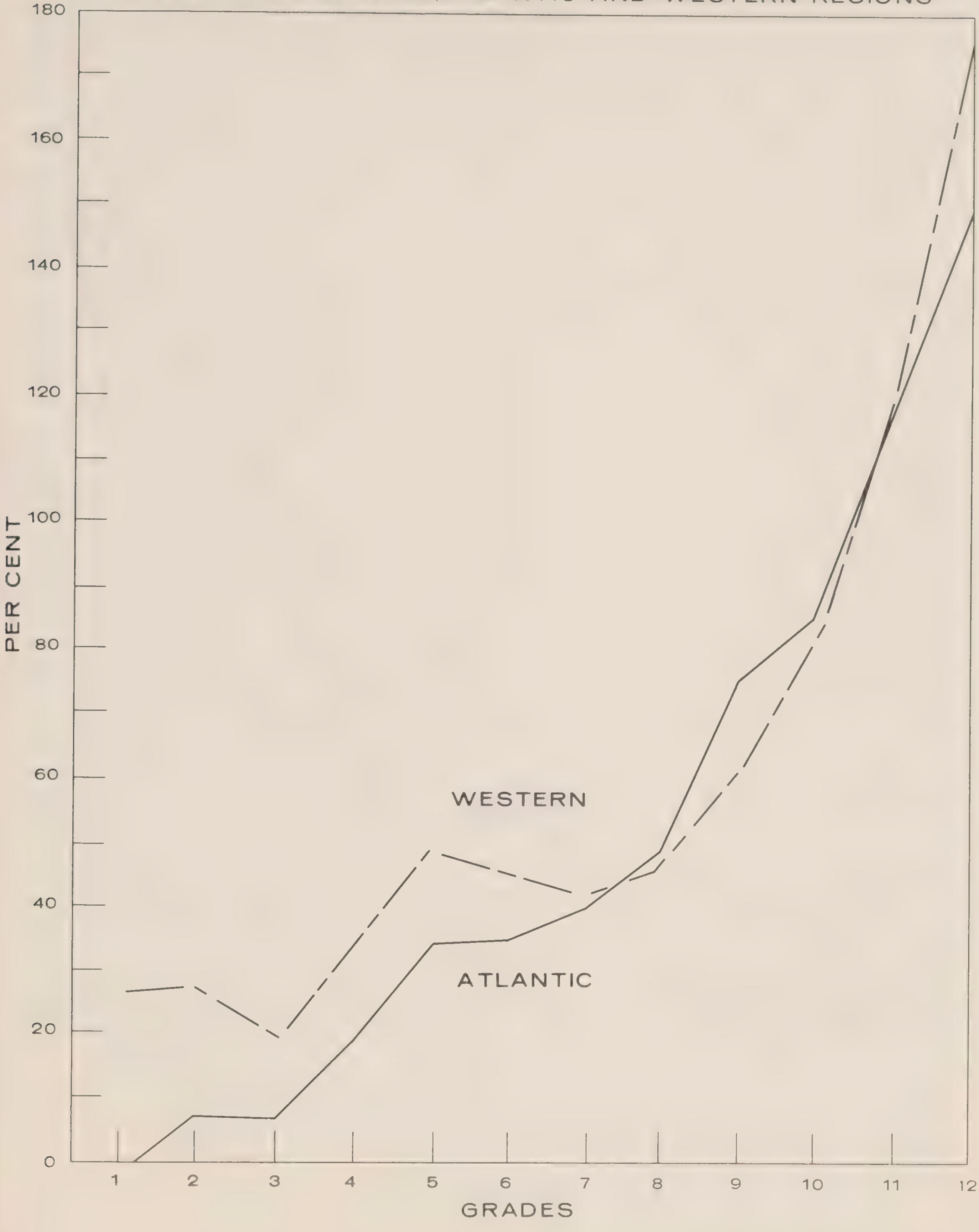


FIGURE 2-5

Atlantic Provinces Per Cent Change in Public School Enrolment, 1956-1965, by Grades

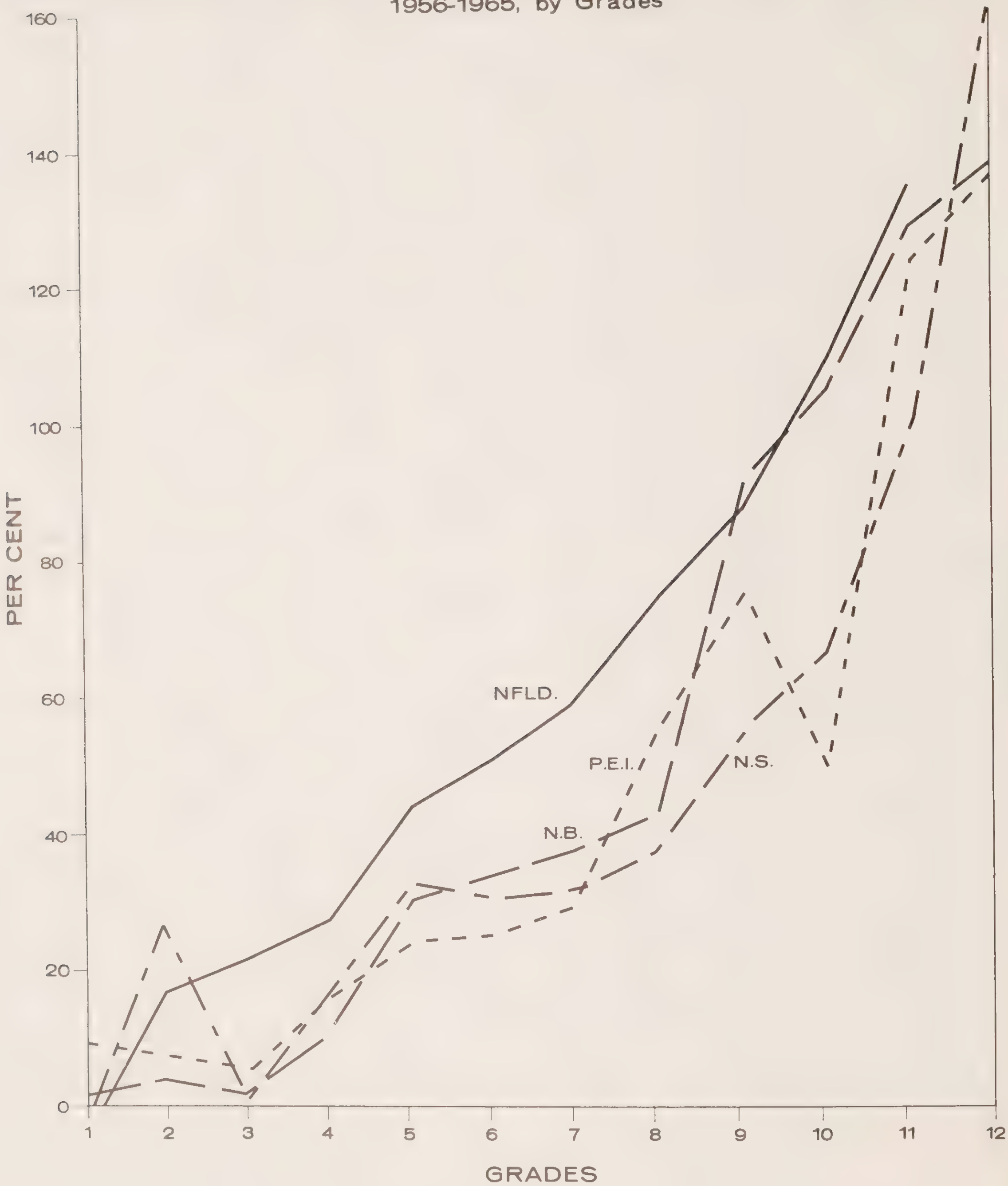
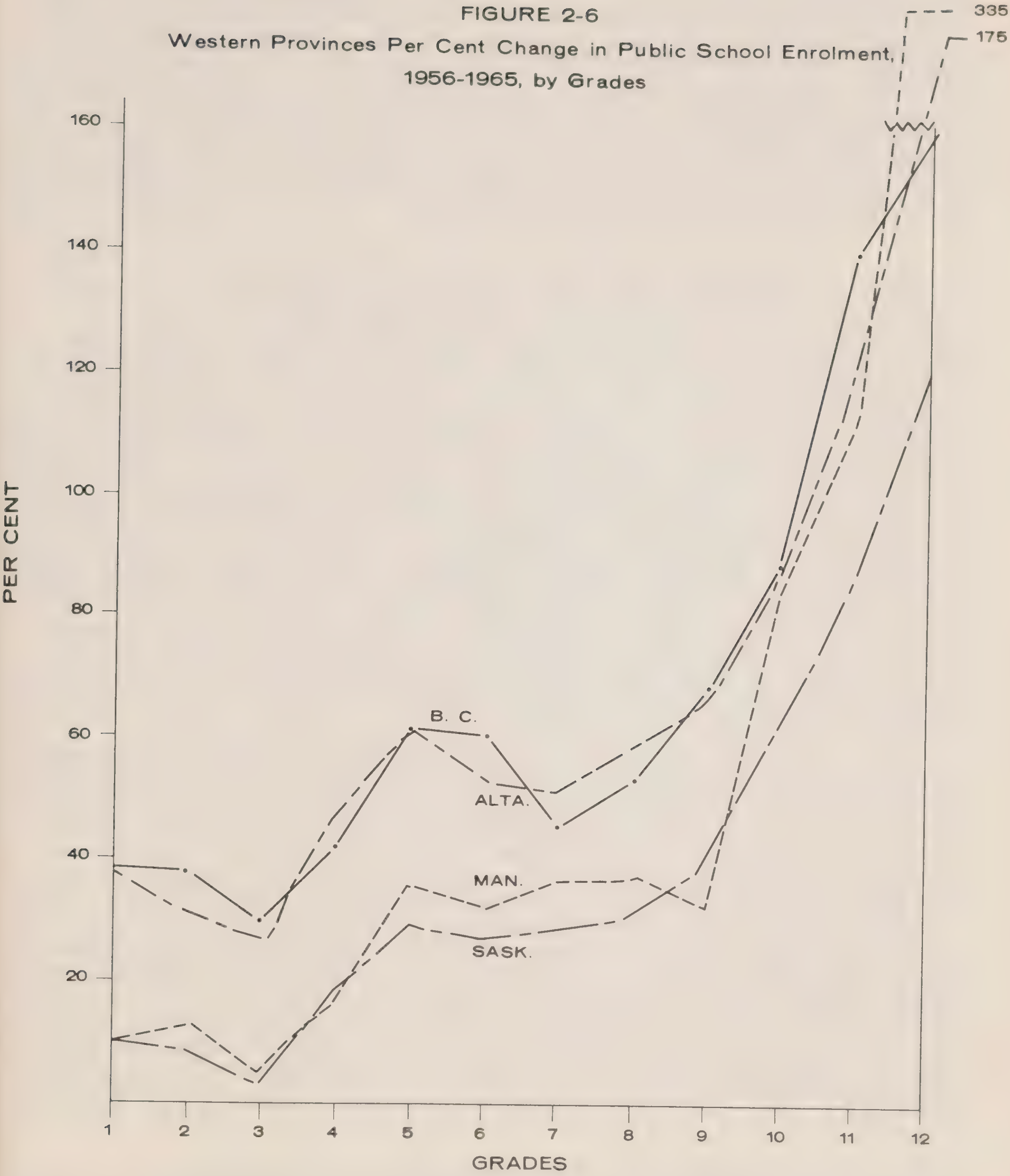


FIGURE 2-6

Western Provinces Per Cent Change in Public School Enrolment, 1956-1965, by Grades



1966, compared with 19 per cent in 1956. An indication of the percentage of the 15-19 population in school is given in Table 2-7, column (d). The Atlantic Region had 51 per cent of that age group in school in 1965, the Western Region 58 per cent. The range extended from 46 per cent in Newfoundland to 66 per cent in British Columbia. Within the Atlantic Region the percentage of boys in school in the 15-19 age group ranged from 46.8 per cent in Prince Edward Island to 53.1 per cent in Nova Scotia. The range for girls was from 40.9 per cent in Newfoundland to 50 per cent in Nova Scotia and Prince Edward Island. In the Western Region the enrolment of boys in this age group ranged from 54.2 per cent in Saskatchewan to 68.2 per cent in British Columbia, and of girls from 47.9 per cent in Manitoba to 62.6 per cent in British Columbia.

An enrolment index is presented in Table 2-7, column (c) which represents the ratio of the 5-19 enrolment in elementary and secondary schools to the 5-19 population. For 1965 the enrolment indexes were almost the same for both regions. On a provincial basis the range extends from .72 in Manitoba to .78 in Nova Scotia. The index for each province is affected by the admission policies, promotion policies, and dropout rates of its schools. For example, in some provinces the public school systems enrol pupils in preprimary classes at age 5, while others commence public school education in Grade 1 at age 6. In Nova Scotia nearly 18,000 pupils, and in Newfoundland nearly 7,500 pupils were enrolled in preprimary classes in 1965. This accounted for 9 per cent of Nova Scotia's total public school enrolment and 5 per cent of Newfoundland's. Alberta, on the other hand, reported no pupils enrolled in this category, there being no provincial grants for preprimary education. However, as already shown, Alberta had a higher percentage of the 15-19 age group in school than did the two Atlantic Provinces so that the indexes representing total enrolments are fairly close.

Table 2-8 presents the increase and per cent increase in elementary and secondary school enrolments from 1956 to 1966. In the Atlantic Region, elementary school enrolments increased by 22.2 per cent and secondary school enrolments by 92.8 per cent. In 1965-66, 20.4 per cent of the total school enrolment in that region was found at the secondary level, compared with only 14 per cent ten years earlier. In the Western Region, secondary school pupils accounted for 26 per cent of the total school population in 1965-66, compared with 20 per cent in 1955-56. There was a 96-per-cent increase in secondary school enrolments in the West during that decade and a 43-per-cent increase in elementary school enrolments. Figure 2-4 illustrates the per cent change in enrolment from 1956 to 1965, by grade, for the two regions. Figures 2-5 and 2-6 illustrate this enrolment change for the individual provinces in the Atlantic and Western Regions.

It is apparent from these tables and figures that a considerable increase in education load occurred in all provin-

ces from 1956 to 1966. This fact is underlined when a weighting of 1.6 is given to the greatly increased enrolments in the secondary school grades. A major part of this increase can be attributed to the post-war population bulge which moved through the secondary school-age group during this decade. Another contributing factor, however, was the increased retention rates of the secondary schools. This factor will be given further consideration in later sections. The levelling off of the secondary school population, which may be anticipated during the next decade, could result in a general reduction in education load for all provinces as a result of the changing ratio between the school-age and working-age population. This trend may be offset, however, by a continued improvement in the holding power of the school which would increase the percentage of the 15-19 age group enrolled.

Teacher Supply and Distribution

From 1961 to 1967 there was an increase of 23 per cent in the number of teachers employed in the Atlantic Provinces compared with an increase of 35 per cent in the Western Provinces. The increase in the Atlantic Region for elementary teachers was 13 per cent, and for secondary teachers 59 per cent. The West experienced an increase of 19 per cent in elementary teachers and 70 per cent in secondary teachers. Table 2-9 presents, for each province, the total number of teachers employed and the per cent increase for each five-year period from 1951 to 1967. Table 2-10 presents, for elementary and secondary teachers separately, the increase from 1961 to 1967 by province and region.

The distribution of teachers in each province by sex and school level is given for 1966-67 in Table 2-11. Twenty per cent of the teachers in the Atlantic Provinces were in secondary schools, compared with 30 per cent in the Western Provinces. Both regions had about 10 per cent of their teachers in combined elementary-secondary schools. In Prince Edward Island 72 per cent of the teachers were in elementary schools compared with 57 per cent in British Columbia.

Male teachers constituted 27 per cent of the teaching force in the Atlantic Region and 39 per cent of the teaching force in the Western Region in 1966-67. British Columbia had the highest percentage of male teachers - 44 per cent, Prince Edward Island the lowest - 21 per cent. At the elementary level only 14 per cent of the teachers were male in the Atlantic Provinces compared with 22 per cent in the West. Fifty-six per cent of the secondary teachers in the Atlantic Provinces were male compared with 67 per cent in the Western Provinces. Among the Atlantic Provinces Newfoundland employed the largest percentage of male teachers at all levels of schooling.

In Appendix B, Tables B-1 and B-2 present a distribution of teachers by sex, school level, and community size, for

TABLE 2-9

Increase in All Teachers Employed, 1951-1967

Province or Region	Number Employed 1950-51	1955-56	1960-61	1966-67*	Per Cent Increase 1951-56	1956-61	1961-67	1951-67
Newfoundland	2,499	3,106	4,317	5,644	24.3	39.0	30.7	125.9
Prince Edward Island	719	822	969	1,318	14.3	17.9	36.0	83.3
Nova Scotia	4,436	5,586	6,664	8,033	25.9	19.3	20.5	81.1
New Brunswick	3,907	4,636	5,866	6,927	18.7	26.5	18.1	77.3
Atlantic	11,561	14,150	17,816	21,922	22.4	25.9	23.0	89.6
Manitoba	4,990	6,080	7,460	9,432	21.8	22.7	26.4	89.0
Saskatchewan	7,218	7,624	8,638	10,923	5.6	13.3	26.5	51.3
Alberta	6,788	8,391	11,762	16,358	23.6	40.2	39.1	141.0
British Columbia	6,272	8,539	11,868	16,966	36.1	39.0	43.0	170.5
Western	25,268	30,634	39,728	53,679	21.2	29.7	35.1	124.3

* Derived from unpublished D.B.S. data.

Source: D.B.S. Salaries and Qualifications of Teachers, 1950-51, 1955-56, 1960-61.

TABLE 2-10

Increase in Elementary and Secondary Teachers Employed, 1961-67

Province or Region	Elementary				Secondary			
			Increase				Increase	
	1961	1967	No.	%	1961	1967	No.	%
Newfoundland	3,543	4,353	810	22.9	774	1,291	517	66.8
Prince Edward Island	812	953	141	17.4	157	365	208	132.5
Nova Scotia	5,013	5,476	463	9.2	1,651	2,557	906	54.9
New Brunswick	4,359*	4,658	299	6.9	1,507*	2,269	762	50.6
Atlantic	13,727	15,440	1,713	12.5	4,089	6,482	2,393	58.5
Manitoba	5,450*	6,092	642	11.8	2,010*	3,340	1,330	66.2
Saskatchewan	6,624	7,192	568	8.6	2,014	3,731	1,717	85.3
Alberta	7,849	9,459	1,610	20.5	3,913	6,899	2,986	76.3
British Columbia	7,367	9,762	2,395	32.5	4,501	7,204	2,703	60.1
Western	27,290	32,505	5,215	19.1	12,438	21,174	8,736	70.2

* D.B.S. Estimates for New Brunswick and Manitoba include teachers not reporting that year.

Source: Derived from D.B.S. Salaries and Qualifications of Teachers in Public Elementary and Secondary Schools, 1960-61; D.B.S. Education Division for 1966-67 data.

TABLE 2-11

Distribution of Male and Female Teachers by Teaching Level, 1966-67

Province or Region		All Schools			Elementary			Combined El.-Sec.			Secondary		
		M	F	T	M	F	T	M	F	T	M	F	T
Nfld.	(no.)	1,986	3,658	5,644	936	3,165	4,101	458	194	652	592	299	891
	(%)	35.2	64.8	100.0	22.8	77.2	72.7	70.2	29.8	11.5	66.4	33.6	15.8
P.E.I.	(no.)	272	1,046	1,318	89	861	950	17	20	37	166	165	331
	(%)	20.6	79.4	100.0	9.4	90.6	72.1	45.9	54.1	2.8	50.2	49.8	25.1
N.S.	(no.)	1,926	6,107	8,033	582	4,876	5,458	567	531	1,098	777	700	1,477
	(%)	24.0	76.0	100.0	10.7	89.3	67.9	51.6	48.4	13.7	52.6	47.4	18.4
N.B.	(no.)	1,741	5,186	6,927	480	4,160	4,640	405	336	741	856	690	1,546
	(%)	25.1	74.9	100.0	10.3	89.7	67.0	54.7	45.3	10.7	55.4	44.6	22.3
Atlantic	(no.)	5,925	15,997	21,922	2,087	13,062	15,149	1,447	1,081	2,528	2,391	1,854	4,245
	(%)	27.0	73.0	100.0	13.8	86.2	69.1	57.2	42.8	11.5	56.3	43.7	19.4
Man.	(no.)	3,408	6,024	9,432	1,346	4,733	6,079	427	338	765	1,635	953	2,588
	(%)	36.1	63.9	100.0	22.1	77.9	64.5	55.8	44.2	8.1	63.2	36.8	27.4
Sask.	(no.)	4,088	6,835	10,923	1,560	5,596	7,156	572	354	926	1,956	885	2,841
	(%)	37.4	62.6	100.0	21.8	78.2	65.5	61.8	38.2	8.5	68.8	31.2	26.0
Alta.	(no.)	6,115	10,243	16,358	1,718	7,653	9,371	1,894	1,339	3,233	2,503	1,251	3,754
	(%)	37.4	62.6	100.0	18.3	81.7	57.3	58.6	41.4	19.8	66.7	33.3	22.9
B.C.	(no.)	7,447	9,519	16,966	2,604	7,116	9,720	255	157	412	4,588	2,246	6,834
	(%)	43.9	56.1	100.0	26.8	73.2	57.3	61.9	38.1	2.4	67.1	32.9	40.3
Western	(no.)	21,060	32,621	53,681	7,228	25,098	32,326	3,148	2,188	5,336	10,682	5,355	16,037
	(%)	39.2	60.8	100.0	22.4	77.6	60.2	59.0	41.0	9.9	66.6	33.4	29.9

Source: Derived from D.B.S. unpublished data.

each of the Atlantic Provinces. In 1966-67 45 per cent of all teachers were to be found in rural schools and 28 per cent in urban centres of 10,000 or more population. A somewhat lower percentage of the male teachers than of the female teachers was found in the rural areas in all Atlantic Provinces except Newfoundland.

During the three-year period 1964-67 the average retention rate of teachers in the Atlantic Provinces was 83 per cent compared with 86 per cent in the Western Provinces. During that period, however, the retention rate for the Atlantic Provinces fell from 85.0 per cent in 1964-65 to 80.7 per cent in 1966-67. In the Western Provinces the rate declined from 86.6 per cent to 84.4 per cent. The Western Provinces retained about 5 per cent more of their teachers in the same school district than did the Atlantic Provinces. British Columbia and Nova Scotia had an average retention rate in the same district of about 80 per cent from 1964-67, but Newfoundland had an average of only 57 per cent.

A picture of the retention, losses, and recruitment of teachers in 1966-67, as derived from D.B.S. data, is produced in Table 2-12 for the Atlantic Provinces and in Table 2-13 for the Western Provinces. From these tables it would appear that the teacher retention rate for the Atlantic Region as a whole was some 2 per cent below that of the Western Region in that year. British Columbia had the highest teacher retention rate of 87.5 per cent, followed by Nova Scotia with 86.3 per cent. Newfoundland had the lowest retention rate of 73.4 per cent, and also the lowest rate of retention in the same district, 56.8 per cent. However, a larger percentage of the losses in Newfoundland were attributed to teachers returning for further training than was the case in the other provinces. This factor may be accounted for by training and certification policies which permit minimal preservice preparation.

In 1966-67, the transfer of teachers to other occupations accounted for a 7.4 per cent loss in the teaching force in Newfoundland, compared with a 0.9 per cent loss in Alberta. From 1964-67 the percentage of teachers lost for this reason increased in Newfoundland, Nova Scotia and Manitoba, but declined in Prince Edward Island and Alberta. Marriage and housekeeping accounted for about 5 per cent of the losses in the teacher force of both Atlantic and Western Regions during the three-year period. The percentage of teacher losses through transfer to teaching positions in other provinces was about 3.5 per cent in Nova Scotia, Manitoba and Alberta in 1966-67. For the provinces reported, the losses through transfers to other provinces would appear to be increasing, suggesting a trend toward greater teacher mobility.

In the Atlantic Region 62.8 per cent of the new teachers in 1966-67 were supplied by training institutions, compared with 57.4 per cent in the Western Region. In Newfoundland al-

TABLE 2-12

Teacher Supply, 1966-67, Atlantic Provinces

	Nfld.		P.E.I.		N.S.		N.B.		Atl. Region	
	no.	%	no.	%	no.	%	no.	%	no.	%
Staff 1965-66	5,545		1,209		7,897		6,812		21,463	
Retention										
District	3,151	56.8	884	73.1	6,220	78.8	4,782	70.2	15,037	70.1
Elsewhere	923	16.6	184	15.2	592	7.5	992	14.6	2,691	12.5
Total Retention	4,074	73.4*	1,068	88.3*	6,812	86.3*	5,774	84.8*	17,728	82.6*
Losses										
Training		10.6		2.9		1.9		n.a.		
Other occupations		7.4		1.2		1.9		n.a.		
Housekeeping		5.8		4.5		4.5		n.a.		
Admin. positions in Ed.		n.a.		n.a		0.4		n.a.		
Teaching elsewhere		1.9		2.2		3.4		n.a.		
Other		0.8		0.8		1.5		n.a.		
Total Losses	1,471	26.5*	141	11.7*	1,085	13.7*	1,038	15.2*	3,735	17.4*
Recruitment										
Colleges	455	29.0	45	18.0	118	9.7	207	18.0	825	19.7
Other training	641	40.8	73	29.2	586	48.0	506	43.9	1,806	43.1
Other occupations	417	26.6	94	37.6	335	27.4	320	27.7	1,166	27.8
Teachers from other provinces	57	3.6	38	15.2	182	14.9	120	10.4	397	9.4
Total Recruitment	1,570	27.6‡	250	19.0‡	1,221	15.2‡	1,153	16.6‡	4,194	19.1‡
Staff 1966-67	5,644		1,318		8,033		6,927		21,922	
Staff Increase 1965-66 - 1966-67	99	1.8	109	9.0	136	1.7	115	1.7	459	2.1

* Per cent of 1965-66.

‡ Per cent of 1966-67.

n.a. - not available.

Source: Derived from D.B.S. unpublished data.

TABLE 2-13

Teacher Supply. 1966-67, Western Provinces

	Man.		Sask.		Alta.		B.C.		West. Region	
	no.	%	no.	%	no.	%	no.	%	no.	%
Staff 1965-66	9,232		10,500		15,518		15,759		51,009	
Retention										
District	6,519	70.6	7,525	71.7	11,996	77.3	12,413	78.8	38,453	75.4
Elsewhere	1,082	11.7	980	9.3	1,162	7.5	1,380	8.7	4,604	9.0
Total Retention	7,601	82.3*	8,505	81.0*	13,158	84.8*	13,793	87.5*	43,057	84.4*
Losses										
Training		3.9		n.a.		4.3		n.a.		
Other occupations		3.5		n.a.		0.9		n.a.		
Housekeeping		5.2		n.a.		4.7		n.a.		
Admin. positions in Ed.		0.7		n.a.		0.9		n.a.		
Teaching elsewhere		3.5		n.a.		3.3		n.a.		
Other		0.9		n.a.		1.1		n.a.		
Total Losses	1,631	17.7	1,995	19.0	2,360	15.2	1,966	12.5	7,952	15.6
Recruitment										
Colleges	372	20.3	235	9.7	525	16.4	181	5.7	1,313	12.4
Other training	815	44.5	1,230	50.9	1,296	40.5	1,441	45.4	4,782	45.0
Other occupations	424	23.2	538	22.2	713	22.3	651	20.5	2,326	21.9
Teachers from other provinces	220	12.0	415	17.2	666	20.8	900	28.4	2,201	20.7
Total Recruitment	1,831	19.4‡	2,418	22.1‡	3,200	19.6‡	3,173	18.7‡	10,622	19.8‡
Staff 1966-67	9,432		10,923		16,358		16,966		53,679	
Staff Increase 1965-66 - 1966-67	200	2.2	423	4.0	840	5.4	1,207	7.7	2,670	5.2

* Per cent of 1965-66.

‡ Per cent of 1966-67.

n.a. - not available.

Source: Derived from D.B.S. unpublished data.

most 70 per cent of the new teachers came from training institutions, whereas in Prince Edward Island only 47.6 per cent were supplied from this source. In British Columbia the percentage of recruits from training institutions was 51.1 per cent, the lowest in the Western Region.

The Western Provinces recruited a much higher percentage of their teachers from outside the province than did the Atlantic Provinces. During one period, 1964-67, the Atlantic Region received about 9 per cent of its new teachers from other provinces, whereas the Western Region recruited 15 per cent of its new teachers in this manner in 1964-65 and 21 per cent in 1966-67. In British Columbia the percentage of new teachers supplied from outside the province had increased from 20 per cent in 1964-65 to 28 per cent in 1966-67. In Newfoundland the supply from outside sources was 2.2 per cent in 1964-65 and 3.6 per cent in 1966-67.

Transfers from other occupations provided 27.8 per cent of the new teachers in the Atlantic Region in 1966-67, compared with 21.9 per cent in the Western Region. Prince Edward Island received 37.3 per cent of its new teachers from this source. Many would undoubtedly be housewives.

Teacher Qualifications

Two major variables determine those teacher qualifications which can be measured in an objective manner, though it is recognized that many subjective criteria may also enter into teacher effectiveness. These two variables are training and experience. There are, of course, both quantitative and qualitative dimensions to both of these variables but this study will limit itself to those quantitative measures which can be reported objectively.

Two aspects of teacher experience considered, aspects which may influence a teacher's effectiveness in a school district, are tenure and total experience. Tenure is a term used in D.B.S. reports, and in this study, to refer to length of teaching experience in a particular school district, as opposed to total experience, which would also include that gained in other districts. There is a basic assumption that, up to a point at least, a teacher's effectiveness improves with experience and that some continuity with the same school district is necessary to make the maximum contribution to its educational programs.

Considering Canada as a whole, there was a general increase in the median tenure of elementary teachers between 1961 and 1967, as indicated in Table 2-14. The median tenure of secondary teachers showed a decrease during that period in four of the provinces and remained about the same in two others. This trend could be related to the expansion of secondary school

TABLE 2-14

A. Median Tenure,*

Male and Female Elementary Teachers and Principals

Province	1960-61			1966-67‡			Change '61-67		
	M	F	T	M	F	T	M	F	T
Newfoundland	0:0	1:4	1:2	1:2	1:7	1:6	1:2	0:3	0:4
Prince Edward Island	1:4	2:0	1:9	2:4	2:2	2:2	1:0	0:2	0:3
Nova Scotia	2:5	4:4	4:2	2:8	5:6	5:2	0:3	1:2	1:0
New Brunswick	1:3	2:7	2:5	1:5	4:1	3:7	0:2	1:4	2:2
Manitoba	1:6	2:4	2:1	2:2	2:3	2:3	0:6	-0:1	0:2
Saskatchewan	1:9	2:4	2:2	2:6	2:8	2:7	0:7	0:4	0:5
Alberta	2:9	3:1	3:1	3:3	4:0	3:8	0:4	0:9	0:7
British Columbia	3:2	3:0	3:0	3:9	2:7	2:9	0:7	0:3	-0:1

B. Median Tenure,*

Male and Female Secondary Teachers and Principals

Province	1960-61			1966-67‡			Change '61-67		
	M	F	T	M	F	T	M	F	T
Newfoundland	2:2	2:3	2:2	2:0	2:6	2:2	-0:2	0:3	0:0
Prince Edward Island	2:8	2:5	2:7	1:9	2:7	2:2	-0:9	0:2	-0:5
Nova Scotia	3:7	3:8	3:8	3:0	4:1	3:5	-0:7	0:3	-0:3
New Brunswick	2:7	4:0	3:1	2:9	3:7	3:2	0:2	-0:3	0:1
Manitoba	2:2	3:3	2:6	3:0	2:7	2:9	0:8	-0:6	0:3
Saskatchewan	3:5	2:7	3:2	3:0	2:8	2:9	-0:5	0:1	0:7
Alberta	3:9	3:7	3:8	3:1	3:3	3:2	-0:8	-0:4	-0:6
British Columbia	4:8	4:0	4:6	4:3	3:4	4:0	-0:5	-0:6	-0:6

* In years : months.

‡ Derived from D.B.S. unpublished data.

Source: D.B.S. Salaries and Qualifications, 1960-61.

enrolments during that period which consequently required an increase in the number of new teachers employed. Nova Scotia and New Brunswick had the greatest increases in median tenure of elementary teachers while the greatest decline in tenure of secondary teachers occurred in Alberta and British Columbia. Of the eight provinces reported, Nova Scotia had the highest median tenure for elementary teachers (5 years, 2 months) and British Columbia had the highest for secondary teachers (4 years, 0 months).

The tenure of female elementary teachers is shown to be significantly higher than that for male elementary teachers in all Atlantic Provinces except Prince Edward Island, which had a median for males of 2:4 1/ and for females of 2:2. Nova Scotia had the very high median tenure for female elementary teachers of 5:6 and for female secondary teachers of 4:1, the highest of all eight provinces. British Columbia had the highest rate of tenure for male teachers - 3:9 for elementary teachers and 4:3 for secondary. The median tenure for male elementary teachers in Newfoundland in 1966-67 was only 1:2.

In terms of median years of total experience for all teachers, all of the Atlantic Provinces, except Newfoundland, would exceed the national average in 1967. However, the median experience of both elementary and secondary male teachers in the Atlantic Provinces was considerably below that of male teachers in the Western Provinces, and considerably below that of female teachers in both regions. In Table 2-15 will be found the median years of experience of elementary and secondary teachers, male and female, for 1960-61 and 1966-67. With a median of 10:9 Nova Scotia had the most experienced elementary teachers of all eight provinces. Alberta, with a median of 9:0 was the next highest. The differential between male and female elementary teachers on this variable was most pronounced, however, in Nova Scotia. The median experience for males was 5:8 and for females 11:7. In Alberta the median for males was 7:3 and for females 9:4. At the secondary level the median experience for male teachers in Nova Scotia was 7:1 and for females 11:5. These medians represented the highest in the Atlantic Provinces. The median experience of both male and female elementary teachers in Newfoundland was the lowest of all eight provinces, being 3:0 for males and 4:0 for females. Prince Edward Island had the lowest median level of experience for male secondary teachers.

The other major variable associated with teacher qualifications is level of training. Tables 2-16 and 2-17 compare levels of training in terms of certificate level, or years of

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1/ i.e., 2 years and 4 months.

TABLE 2-15

A. Median Years Experience,*

Male and Female Elementary Teachers and Principals

Province	1960-61			1966-67‡			Change '61-67		
	M	F	T	M	F	T	M	F	T
Newfoundland	2:1	3:4	2:9	3:0	4:0	3:8	0:9	0:6	0:9
Prince Edward Island	4:2	6:9	6:8	6:8	8:9	8:7	2:6	2:0	1:9
Nova Scotia	5:7	10:1	9:7	5:8	11:7	10:9	0:1	1:6	1:2
New Brunswick	3:2	8:0	7:3	3:4	9:3	8:5	0:2	1:3	1:2
Manitoba	5:1	7:5	6:9	5:8	6:2	6:1	0:7	-1:3	-0:8
Saskatchewan	6:4	8:2	7:9	5:4	6:6	6:3	-1:0	-1:6	-1:6
Alberta	8:0	9:1	8:9	7:3	9:4	9:0	-0:7	0:3	0:1
British Columbia	6:6	7:6	7:3	7:5	6:7	6:9	0:9	-0:9	-0:4

B. Median Years Experience,*

Male and Female Secondary Teachers and Principals

Province	1960-61			1966-67‡			Change '61-67		
	M	F	T	M	F	T	M	F	T
Newfoundland	8:9	12:3	9:8	6:5	8:9	7:0	-2:4	-3:4	-2:8
Prince Edward Island	6:9	13:8	12:1	4:5	8:9	6:1	-2:4	-4:9	-6:0
Nova Scotia	8:7	12:1	10:2	7:1	11:5	8:6	-1:6	-0:6	-1:6
New Brunswick	6:6	11:0	8:5	5:9	9:0	7:1	-0:7	-2:0	-1:4
Manitoba	8:9	10:8	9:4	7:4	7:1	7:3	-1:5	-3:7	-2:1
Saskatchewan	12:2	12:5	12:2	9:5	10:1	9:7	-2:7	-2:4	-2:5
Alberta	11:4	12:0	11:6	7:1	9:1	7:7	-4:3	-2:9	-3:9
British Columbia	10:0	10:9	10:2	9:4	8:9	9:2	-0:6	-2:0	-1:0

* In years : months.

‡ Derived from D.B.S. unpublished data.

Source: D.B.S. Salaries and Qualifications, 1960-61.

TABLE 2-16

Qualifications by Certificate Level* of Teachers and Principals, 1960-61 and 1966-67

1960-61	Elementary					Secondary				
	0-1	1	2	3-4	5+	0-1	1	2	3-4	5+
	%	%	%	%	%	%	%	%	%	%
Nfld.	54.5	31.3	8.2	6.0	0.0	22.9	21.7	17.4	52.6	0.0
P.E.I.	42.1	47.5	6.5	2.7	1.1	5.7	38.2	18.5	17.8	19.7
N.S.	12.8	24.4	41.8	10.0	11.0	3.0	3.5	15.1	17.7	58.3
N.B.	19.1	54.1	17.9	4.8	4.2	4.0	25.5	18.6	10.8	40.3
Atlantic	27.3	36.3	23.4	6.9	5.4	4.4	16.3	17.0	22.1	39.1
Man.	2.2	20.2	69.7	1.0	6.7	9.9	1.7	28.6	7.4	46.6
Sask.	1.1	2.7	57.5	33.8	4.3	1.4	0.7	9.1	29.9	57.2
Alta.	8.4	6.7	52.9	31.9	0.0	3.3	0.7	19.2	76.7	0.0
B.C.	1.4	11.2	52.0	21.2	14.2	2.8	1.6	9.0	13.5	73.2
Western	3.6	9.4	56.8	23.7	6.4	3.9	1.2	15.2	33.9	44.6
1966-67‡										
Nfld.	35.6	42.2	11.2	8.8	2.2	2.9	17.8	17.1	36.1	26.1
P.E.I.	23.5	46.2	21.9	5.5	2.9	7.1	12.6	15.9	23.3	41.1
N.S.	9.5	15.3	35.5	24.0	15.7	3.8	1.5	8.1	24.0	62.6
N.B.	15.9	28.0	42.5	11.5	2.1	2.5	9.4	28.4	34.6	25.1
Atlantic	19.7	28.6	30.0	14.8	7.0	3.3	8.1	17.4	30.1	41.0
Man.	4.0	14.4	73.3	0.0	8.3	11.0	2.1	22.4	0.0	64.5
Sask.	2.6	1.0	29.9	57.4	9.1	2.6	0.1	4.2	27.3	65.8
Alta.	6.7	3.4	36.2	53.7	0.0	3.9	0.3	9.4	86.4	0.0
B.C.	1.5	3.5	39.4	42.4	13.2	2.5	0.5	6.0	17.8	73.2
Western	3.7	5.0	42.7	41.1	7.5	4.2	0.6	9.2	39.5	46.4

* Years of training beyond junior matriculation.
‡ Derived from D.B.S. unpublished data.

Source: D.B.S. Salaries and Qualifications, 1960-61.

TABLE 2-17

Percentage Point Change in Teachers' Qualifications by Certificate Level, 1960-61 to 1966-67

Province or Region	Elementary					Secondary				
	0-1	1	2	3-4	5+	0-1	1	2	3-4	5+
Nfld.	-18.9	10.9	3.0	2.8	2.2	-20.0	- 3.9	-0.3	-16.5	26.1
P.E.I.	-18.6	- 1.3	15.4	2.8	1.8	1.4	-25.6	-2.6	5.5	21.4
N.S.	- 3.3	- 9.1	- 6.3	14.0	4.7	0.8	- 2.0	-7.0	6.3	4.3
N.B.	- 3.2	-26.1	24.6	6.7	-2.1	-1.5	-16.1	9.8	23.8	-15.2
Atlantic	- 7.6	- 7.7	6.6	7.9	1.6	-1.0	- 8.2	0.4	8.0	1.9
Man.	1.8	- 5.8	3.6	- 1.0	1.6	1.1	0.4	-6.2	- 7.4	17.9
Sask.	1.5	- 1.7	-27.6	23.6	4.8	1.2	- 0.6	-4.9	- 2.6	8.6
Alta.	- 1.7	- 3.3	-16.7	21.8	0.0	0.6	- 0.4	-9.8	9.7	0.0
B.C.	0.1	- 7.7	-12.6	21.2	-1.0	-0.3	- 1.1	-3.0	4.3	73.2
Western	0.1	- 4.4	-14.1	17.4	1.1	0.3	- 0.6	-6.0	5.6	1.8

Source: D.B.S. Salaries and Qualifications,1960-61; D.B.S. unpublished data.

training beyond junior matriculation.1/ In the first column of these tables will be found the number and per cent of teachers with less than one year of training beyond junior matriculation. In some instances they may have had no professional training at all, in other cases training may have been limited to a summer session of a few weeks. In a small percentage of cases a teacher in this category may have qualifications from outside the province which are yet to be evaluated and meanwhile would be teaching under a special letter of authority.

When the data for 1960-61 are compared with those for 1966-67 a general upgrading of teacher qualifications is evident. In the earlier year only 12.3 per cent of the elementary teachers and 61.2 per cent of the secondary teachers in the Atlantic Provinces had three or more years of training. In 1966-67 the percentages had risen to 21.8 and 71.1. In both years the percentage of teachers with three or more years of training was very much higher in the Western Region. In 1960-61, 30.1 per cent of the elementary teachers had three or more years of training, in 1966-67 the percentage was 48.6. In the same interval the percentage of secondary teachers in the Western Region with this level of training had risen from 78.5 to 85.9. The percentage increase in the Western Region for both elementary and secondary teachers was almost double that in the Atlantic Region during this period.

In 1966-67, 77.8 per cent of the elementary teachers in Newfoundland had one year or less of teacher preparation beyond junior matriculation. In Nova Scotia 24.8 per cent of the elementary teachers were in this category, in Saskatchewan only 3.6 per cent. In Prince Edward Island the percentage was 69.7, and in New Brunswick 43.9, for elementary teachers with one year or less of training. Manitoba was the only Western Province with more than 15 per cent of the elementary teachers in this category.

Table 2-18 presents for each province and region the per cent of teachers with degrees in 1960-61 and in 1966-67. In the Atlantic Region 16.5 per cent of all teachers held a university degree in 1960-61. This had changed to 23.4 per cent in 1966-67, an increase of 6.9 percentage points. In the Western Region the per cent of teachers with degrees in 1960-61 was 27.0, in 1966-67, 38.4, an increase of 11.4 percentage points. In the latter year, the Western Region had 7.8 per cent more of its elementary teachers with degrees than the Atlantic Region and 16.8 per cent more of its secondary teachers. Within the Atlantic Region, Nova Scotia had the highest percentage of teachers with degrees in both elementary and secondary schools.

1/ In Appendix B will be found a statement prepared by the Canadian Teachers' Federation giving the level of training equivalents of the variety of teaching certificates issued by the various provinces.

TABLE 2-18

Per Cent of Teachers with Degrees, 1960-61 and 1966-67

Province or Region	1960-61				1966-67*			1961-67
	Elem.	El.-Sec.	Sec.	Total	Elem.	Sec.	Total	Percentage Point Change
Nfld.	3.8	14.9	43.0	10.7	6.0	46.4	15.3	4.6
P.E.I.	2.4	4.3	37.4	7.2	2.8	47.1	15.1	7.9
N.S.	11.4	40.7	71.9	23.8	16.5	64.9	32.0	8.2
N.B.	4.7	21.7	47.3	14.1	7.7	49.8	21.4	7.3
Atlantic	6.9	25.9	54.8	16.5	10.0	54.9	23.4	6.9
Man.	8.7	50.8	65.9	25.6	9.4	70.1	30.9	5.3
Sask.	4.1	15.6	59.7	16.7	9.3	64.0	28.0	11.3
Alta.	10.8	43.2	69.3	27.7	21.9	68.4	41.5	13.8
B.C.	17.1	55.5	81.2	37.0	25.3	74.8	46.3	9.3
Western	10.6	48.3	70.0	27.0	17.8	70.1	38.4	11.4

* Derived from D.B.S. unpublished data.

Source: D.B.S. Salaries and Qualifications,1960-61.

British Columbia had the highest percentage in the Western Region. For elementary teachers the range extended from 2.8 per cent in Prince Edward Island to 25.3 per cent in British Columbia, and for secondary teachers, from 46.4 per cent in Newfoundland to 74.8 per cent in British Columbia. Due to a more rapid increase in the per cent of teachers with degrees in the Western Provinces than in the Atlantic Provinces, the gap in qualifications between regions and provinces is widening. The significance of this finding will be given further consideration in discussion of education output.

Teacher Salaries

Teacher salaries reflect the three variables already considered - levels of training, experience, and tenure - as well as differences among provinces and regions in general wage scales. In Table 2-19 will be found the median salaries of elementary and secondary teachers in each province for 1960-61 and for 1966-67, with the per cent change between these years. For elementary teachers in 1960-61, the median salary in the Atlantic Region was approximately $2,400 compared with about $4,200 for the Western Region - about 75 per cent higher. The median for the Atlantic Region increased by 50 per cent between 1961 and 1967, while the Western median increased by 25 per cent. This left a difference between regions of about $1,700 or 48 per cent in 1966-67, a dollar difference only $100 less than in 1960-61.

In 1960-61 the differential between regions in median salaries of secondary teachers was approximately $2,000, the Western median being about 50 per cent higher than the Atlantic. From 1961 to 1967 the Atlantic median for secondary teachers in-

TABLE 2-19

A. Median Salaries,
Elementary Teachers and Principals

Province	1960-61			1966-67*			% Change 1961-67		
	M	F	T	M	F	T	M	F	T
Nfld.	1,636	2,196	2,136	3,380	3,282	3,315	106.2	49.5	55.2
P.E.I	2,332	2,222	2,233	3,900	3,341	3,382	67.2	50.4	51.5
N.S.	3,218	2,629	2,670	5,090	3,936	3,954	58.2	49.7	48.1
N.B.	2,709	2,431	2,455	4,067	3,505	3,546	50.1	44.2	44.4
Man.	3,583	3,548	3,555	4,702	4,303	4,382	31.2	21.3	23.3
Sask.	4,046	3,943	3,956	5,633	4,825	4,940	39.2	22.4	24.9
Alta.	4,931	4,292	4,333	6,579	5,420	5,509	33.4	26.3	27.1
B.C.	5,385	4,751	4,894	6,717	5,771	6,020	24.7	21.5	23.0
Canada (ex.Qué.)	4,462	3,767	3,882	5,640*	5,704	4,875	26.4	51.4	25.6

B. Median Salaries,
Secondary Teachers and Principals

Province	1960-61			1966-67*			% Change 1961-67		
	M	F	T	M	F	T	M	F	T
Nfld.	4,114	3,721	3,960	5,040	4,507	4,904	22.5	21.1	23.8
P.E.I.	3,749	2,752	3,132	5,125	4,403	4,706	36.7	60.0	50.3
N.S.	4,583	3,963	4,308	6,228	5,804	6,026	35.9	46.5	39.9
N.B.	4,480	3,612	3,977	5,772	4,871	5,347	28.8	34.9	34.4
Man.	5,468	5,004	5,246	7,156	5,950	6,587	30.9	18.9	25.6
Sask.	6,340	5,292	5,390	7,781	6,315	7,185	22.7	19.3	33.3
Alta.	6,782	5,255	6,136	7,594	6,333	7,000	12.0	20.5	14.1
B.C.	7,057	6,143	6,695	8,128	7,075	7,819	15.2	15.2	16.8
Canada ex.Qué.)	6,526	5,532	6,054	7,586	6,470	7,148	16.2	17.0	18.1

Derived from D.B.S. unpublished data.

ource: D.B.S. Salaries and Qualifications, 1960-61, 1964-65.

creased about 35 per cent while the Western median increased about 20 per cent. As a result, by 1966-67 the differential between regions had decreased by approximately $100, the Western median being some 36 per cent higher than the Atlantic median.

Differences in median salaries are to some extent related to the differences in teacher qualifications which have already been reported. In order to indicate the extent to which they may be due to factors other than qualifications, however, average salaries are examined separately for beginning teachers and for teachers with four to nine years experience, for various levels of training and in rural and urban areas. It is hypothesized that teacher recruitment, as well as retention, may be influenced not only by starting salaries but by income opportunities after a number of years of experience. In Appendix B will be found tables which give average salaries for the years 1960-61 and 1966-67, and the per cent change between these years, for both rural and urban teachers, according to level of teaching, level of training, and level of experience.

In 1966-67 the following range in average salaries prevailed for the categories of teachers described:

Elementary teachers with no experience and minimal training:
$2,335 in Nova Scotia to $3,631 in British Columbia.

Elementary teachers with no experience and four to seven years training:
$4,000 in Prince Edward Island to $5,786 in Saskatchewan.

Elementary teachers with four to nine years experience and minimal training:
$3,092 in Nova Scotia to $4,848 in Alberta.

Elementary teachers with four to nine years experience and four to seven years training:
$5,308 in Prince Edward Island to $7,311 in Saskatchewan.

Secondary teachers with no experience and two to four years training:
$3,248 in Newfoundland to $5,018 in British Columbia.

Secondary teachers with no experience and four to seven years training:
$4,132 in Prince Edward Island to $5,843 in Saskatchewan.

Secondary teachers with four to nine years experience and two to three years training:
$4,164 in Nova Scotia to $6,212 in British Columbia.

Secondary teachers with four to nine years experience and four to seven years training:
$5,788 in Newfoundland to $7,900 in Saskatchewan.

In Appendix B will be found recent provincial salary scales for the provinces of New Brunswick and Newfoundland and, for comparative purposes, a sample of salary scales from urban and rural districts of Alberta. The higher qualifications of teachers in the Western Provinces, together with the somewhat higher salary scales, would indicate that current expenditures on education are considerably higher in the Western Region than in the Atlantic Region.

Expenditures on Education

Local and provincial expenditures on elementary and secondary education in 1965 are given in Table 2-20. For the Atlantic Region about 46 per cent of the revenues came from local sources and 54 per cent from provincial sources. In the Western Region the proportions were 51.5 per cent local and 48.5 per cent provincial. In that year 88 per cent of the education revenues in Newfoundland were from provincial sources, while in New Brunswick the province provided only 32 per cent of the revenues.

When expenditures on education were related to the total revenues of local and provincial jurisdictions, the two regions compared as follows in 1965: education expenditures comprised 60 per cent of local and 26.5 per cent of provincial revenues in the Atlantic Region compared with 49.5 per cent of local and 32 per cent of provincial revenues in the Western Region.

The distribution and per cent distribution of school board expenditures in 1967 is shown by province in Table 2-21. In both regions about 14 per cent went for capital expenditures in that year and 86 per cent for operating. In the Atlantic Region teacher salaries accounted for 73.6 per cent of the operating expenditures, while in the Western Region they accounted for 66.8 per cent. Teacher salaries range from 64.1 per cent of the operating expenditures in Saskatchewan to 74.9 per cent of the operating expenditures in Newfoundland. In the Western Provinces a larger proportion of the operating expenses went to other services, such as transportation, than in the Atlantic Provinces.

The increase in expenditures on education from 1956 to 1965 is expressed in Table 2-22 on the basis of "per pupil in average daily attendance" and "per capita". Figure 2-7 illustrates the change from 1951 to 1965 on a "per pupil" basis, and Figure 2-8 the change from 1958 to 1965 on a "per capita" basis. The average per-pupil expenditure of $286 in 1965 represented an increase of 92 per cent from 1956 for the Atlantic Provinces, but remained $237 (45 per cent) below the average for the Western Provinces. Per-pupil expenditures in the West had increased by $231 or 79 per cent during that nine-year period. The range among provinces extended from $216 per pupil in Newfoundland to $581 per pupil in British Columbia in 1965.

TABLE 2-20

Expenditures on Elementary and Secondary Education,* 1965

Province or Region	Expenditures			Revenue Source		Expenditures as % of Total Revenues	
	Local $ 000	Provincial $ 000	Total $ 000	Local %	Prov. %	Local %	Prov. %
Newfoundland	3,426	25,250	28,676	11.9	88.1	6.6	32.4
Prince Edward Island	2,578	4,813	7,391	34.9	65.1	54.1	22.0
Nova Scotia	28,819	31,947	60,766	47.4	52.6	57.0	30.6
New Brunswick	30,906	14,399	45,305	68.2	31.8	75.6	17.7
Atlantic	65,729	76,409	142,138	46.2	53.8	60.3	26.5
Manitoba	48,139	50,290	98,429	48.9	51.1	46.3	32.0
Saskatchewan	56,956	50,071	107,027	53.1	46.7	50.0	25.0
Alberta	86,427	89,159	175,586	49.2	50.8	49.8	39.7
British Columbia	107,834	92,097	199,931	53.9	46.1	49.0	28.4
Western	299,356	281,617	580,973	51.5	48.5	49.5	31.7

* Excluding Federal Grant contributions.

Source: Derived from D.B.S. unpublished data.

TABLE 2-21

School Board Expenditures on Elementary and Secondary Education, 1967

Province or Region	Expenditures					As % of Total			As % of Operating	
	Total	Capital	Operating	Salaries	Other	Capital	Operating	Salaries	Salaries	Other
	$ 000					%	%	%	%	%
Nfld.	26,100	3,455	22,645	16,960	5,685	13.2	86.8	65.0	74.9	25.1
P.E.I.	6,685	974	5,711	3,887	1,824	14.6	85.4	58.1	68.1	31.9
N.S.	54,679	8,048	46,631	34,488	12,143	14.7	85.3	63.1	74.0	26.0
N.B.	40,926	4,875	36,051	26,392	9,659	11.9	88.1	64.5	73.2	26.8
Atlantic	128,390	17,352	111,038	81,727	29,311	13.5	86.5	63.7	73.6	26.4
Man.	80,774	12,073	68,701	46,040	22,661	14.9	85.1	57.0	67.0	33.0
Sask.	99,771	13,545	86,226	55,250	30,976	13.6	86.4	55.4	64.1	35.9
Alta.	164,897	23,939	140,958	95,991	44,967	14.5	85.5	58.2	68.1	31.9
B.C.	185,334	27,274	158,060	105,759	52,301	14.7	85.3	57.1	66.9	33.1
Western	530,776	76,831	453,945	303,040	150,905	14.5	85.5	57.1	66.8	33.2

Source: Derived from D.B.S. unpublished data.

TABLE 2-22

Per-Pupil and Per-Capita Expenditure on Education

Province or Region	Per Pupil in Average Daily Attendance						Per Capita					
	1956	1959	1962	1965*	Change 1959-65	% Change 1959-65	1956	1959	1962	1965	Increase 1959-65	% Increase 1959-65
	$	$	$	$	$	%	$	$	$	$	$	%
Newfoundland	124	152	175	216	64	42.1	27	37	45	57	20	54.1
Prince Edward Island	118	167	227	298	131	78.4	22	32	48	68	36	112.5
Nova Scotia	180	232	292	334	102	44.0	36	50	66	80	30	37.5
New Brunswick	175	210	234	297	87	41.4	36	46	54	72	26	56.5
Atlantic	149	190	232	286	96	50.5	30	41	53	69	28	68.3
Manitoba	222	347	361	483	136	39.2	38	59	72	102	43	72.9
Saskatchewan	278	352	399	495	143	40.6	51	70	86	113	43	61.4
Alberta	328	416	538	531	115	27.6	61	82	116	124	42	51.2
British Columbia	340	419	453	581	162	38.7	53	71	85	119	48	67.6
Western	292	384	438	523	139	36.2	51	71	90	115	44	62.0
Western-Atlantic	143	194	206	237	-	-	21	30	37	46	-	-

* D.B.S. unpublished data.

Source: D.B.S. Survey of Education Finance, 1963.

On a per-capita basis expenditures in the Atlantic Region had increased by $39 or 130 per cent from 1956 to 1965, and in the Western Region by $64 or 125 per cent. The Western per-capita average in 1965 was $46 (67 per cent) above the Atlantic average. The range extended from $57 in Newfoundland to $124 in Alberta.

Expenditure levels on elementary and secondary education reflect differences in education load and differences in teacher salaries and other operating expenditures. They do not necessarily reflect either ability or effort to support education - questions which are not dealt with in this report. The ability to support educational programs is a function not only of provincial income and the proportion of that income taxed by provincial and local government authorities, but also of transfers from the federal government to provincial governments. In recent years there have been significant changes in the system of federal transfers to provincial governments which will undoubtedly affect the ability of the Atlantic Provinces to support education. However, the impact of these changes on education expenditures has not yet been assessed.

FIGURE 2-7

Total Local and Provincial Expenditure on Elementary and Secondary Education Per Pupil in Average Daily Attendance

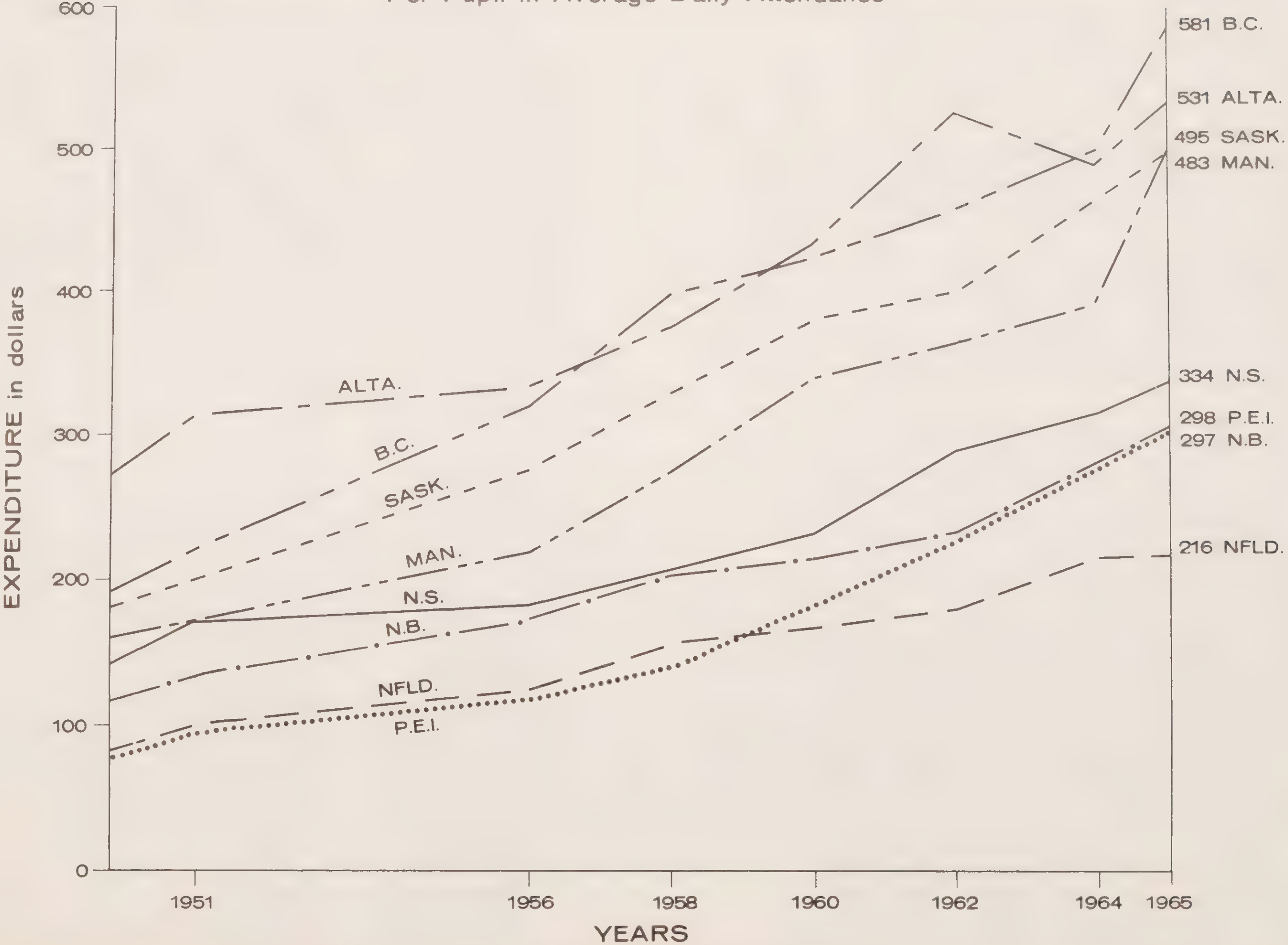
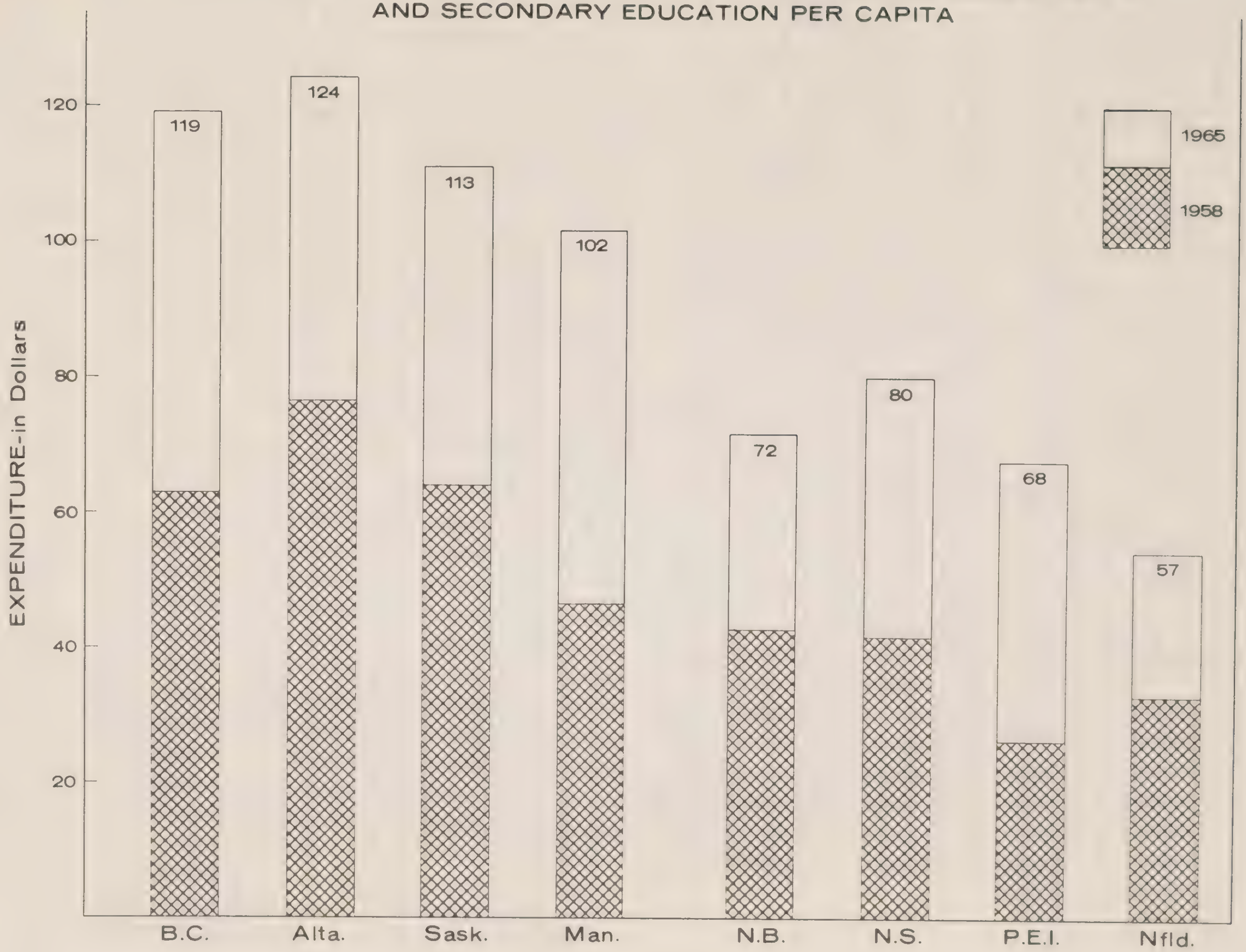


FIGURE 2-8

TOTAL LOCAL AND PROVINCIAL EXPENDITURE ON ELEMENTARY AND SECONDARY EDUCATION PER CAPITA



School Organization

Patterns of school organization have been the subject of serious study and research in both Canada and the United States for more than 40 years. Major attention has been given to the two areas of school district organization and school centralization. The pioneer form of school district organization - the local district or school section which provided a one-room school within walking distance of every home - has gradually been yielding to larger units of administration and centralized schools which could provide a wider range of educational opportunities.

> The chief function of a school district is to make it possible for the citizens of the area to provide for the organization, operation and administration of an adequate, economical, and effective educational program for those who should be educated in and through the public schools. Any district that fails to carry out this function satisfactorily is an ineffective district. The ineffectiveness may be due to the attitude of the people, to the limited size of the area, to inadequate human or economic resources, to failure to recognize or meet emerging needs, or, to any combination of these factors. (Morphet _et_ _al_., 1967: p. 269.)

Following two successful experiments with large units of administration, the Alberta government in the late 1930's introduced a complete plan for the establishment of large school divisions in the rural areas of the province. In 1965 there were 59 such large units. The provinces of British Columbia and Saskatchewan, and more recently Manitoba, Ontario and Québec have also carried out a large-scale school district reorganization. At the present time New Brunswick is introducing its reorganization plan which divides the province into 33 large units, each including both rural and urban areas.1/

Table 2-23 indicates the greatly decreased number of operating school boards in both the Atlantic and Western Provinces in 1966 compared with 1960. Over 600 school boards disappeared in the Atlantic Provinces, and over 1,700 in the Western Provinces during the six-year period. Since 1967 New Brunswick has the highest average number of schools under one board. Much yet remains to be done in the reorganization of school administrative units in the other Atlantic Provinces, however, particularly in Prince Edward Island and Newfoundland.

1/ For a recent review of school district organization in the Canadian Provinces _see_ The Organization and Administration of Public Schools in Canada, Dominion Bureau of Statistics, 1966.

TABLE 2-23

Public School Organization, 1960-66

Province or Region	School Boards*			Schools			Classrooms			Teachers			Pupils		
	1960	1966	1960 -1966	1960 -1961	1966 -1967	1960 -1966	1960 -1961	1966 -1967	1960 -1966	1960 -1961	1966 -1967	1960 -1966	1960 -1961	1966 -1967	1960 -1966
Nfld.	307	270	-37	1,235	1,165	-70	4,011	5,625	1,614	4,317	5,644	1,327	129,276	147,760	18,484
P.E.I.	469	373	-96	448	380	-68	932	1,208	276	969	1,318	349	24,416	28,597	4,181
N.S.	1,576	1,241	-335	1,292	855	-437	6,039	7,685	1,646	6,664	8,033	1,369	179,771	200,681	20,910
N.B.	605	436	-169	1,472	1,050	-422	5,377	6,600	1,223	5,866	6,927	1,061	147,479	166,750	19,271
Atlantic	2,957	2,320	-637	4,447	3,450	-997	16,359	21,118	4,759	17,816	21,922	4,106	481,942	543,788	62,846
Man.	1,631	936	-695	1,730	1,250	-480	5,842	8,950	3,108	7,460	9,432	1,972	183,650	224,532	40,882
Sask.	5,450	4,440	-1,010	2,321	1,250	-1,071	8,189	10,800	2,611	8,638	10,923	2,285	206,430	242,137	35,707
Alta.	204	203	-01	1,100	1,220	120	10,650	16,580	5,930	11,762	16,358	4,596	292,000	372,894	80,894
B.C.	87	87	0	1,247	1,425	178	10,037	15,660	5,623	11,868	16,966	5,098	316,821	439,692	122,871
Western	7,372	5,666	-1,706	6,398	5,145	-1,253	34,718	51,990	17,272	39,728	53,679	13,951	998,901	1,279,255	280,354

* Total of all boards.

Source: D.B.S. Salaries and Qualifications of Teachers in Public Elementary and Secondary Schools, 1960-61; and Preliminary Statistics of Education, 1960-61 and 1966-67.

In a discussion of the desirable minimum size of school districts Morphet writes,

> Research shows that reasonable economy of scale cannot be attained in districts with a school population of fewer than 10,000 pupils. Districts that are smaller in size are faced with rapidly increasing unit costs for an adequate educational program as the number of pupils decreases. In districts of fewer than 1,200 pupils, the unit costs become so great that such opportunities can seldom be provided. Therefore, the minimum acceptable size of school districts should be 10,000 pupils in all except the most sparsely settled areas where the minimum should be established at not less than 5,000. (Morphet et al., 1967: p. 270.)

The Royal Commission on Education and Youth (Newfoundland and Labrador, 1967) gave some consideration to school district reorganization in that province, a problem complicated by the denominational form of organization. Its report stated:

> One of the basic problems of Newfoundland education is the large number of school boards in the Province serving relatively few students. A sparse population, denominational differences, community rivalries, and the lack of adequate transportation and communication services are among the reasons why only 22 out of a total of 270 boards in 1965-66 served 1,000 pupils or more.... Some 40 boards had fewer than 100 pupils in their charge, and another 64 had from 100 to 199 pupils. A total of 200 boards or 74 per cent served fewer than 500 pupils.
>
> Small school boards cannot provide economically the services needed for modern education. They cannot employ a director of education to advise the board or give leadership to the teaching staff. They generally provide small schools with inadequate facilities and restricted educational programmes. They find it difficult to attract and hold quality teachers and principals and are unable to provide specialized services such as health programmes, guidance, library facilities, audio-visual aids, auxiliary classes, and instruction in music, art, physical education, industrial arts, and home economics.

An eventual outcome of the establishment of larger units of administration is some degree of centralization of school facilities. As reorganization of districts results in an equalization of financial resources and responsibilities, so centralization of facilities helps to equalize and extend educational opportunities. The size of school, as well as the size of school district, is an important factor in determining the degree to which professional resources can be attracted,

held, and effectively utilized. A trend toward school centralization is indicated in Table 2-23 which shows a reduction of 1,000 schools in the Atlantic Provinces from 1960 to 1966, and at the same time an increased school enrolment of nearly 63,000. In 1960 there was an average of four teachers per school; in 1966 the average had increased to six. The average enrolment per school was 108 in 1960 and had increased to 158 in 1967. Only a small beginning, however, has been made toward solving the important problems of school centralization.

Table 2-24 indicates the per cent change from 1960 to 1966 in school boards, schools, classrooms, teachers and pupils.

In relation to minimal school size Morphet has stated,

> Whenever practicable an elementary school should have sufficient pupils to warrant at least 2 teachers per grade or age group, and a junior or senior high school should have at least 100 pupils in each age group. Elementary and high schools having at least twice this minimum are usually in a position to provide a more adequate program at a more reasonable cost. (Morphet _et al_., 1967: p. 271.)

Using Morphet's criteria, and adding one more - that not less than three grades should constitute an educational unit - the minimum size of school that might operate with any degree of efficiency and effectiveness would be a six-room school. Such a unit might be suitable for the primary grades where transportation distances were great. A six-grade elementary school organization would require a 12-room school, and an eight-grade elementary school a 16-room school. Using Morphet's criteria for high schools, the minimum size of a three-grade high school would be 300 pupils, or 12 rooms, of a four-grade high school 400 pupils or 16 rooms.

In 1966 there were 400 schools in Nova Scotia and nearly 900 in Newfoundland which would not meet the minimum standard of six rooms. Over 78,000 pupils attended these small schools. There were an additional 106 schools in Nova Scotia and 141 in Newfoundland which had six to eight rooms, accommodating another 36,000 pupils. In Nova Scotia 59 per cent of all schools had eight rooms or less in 1966, and accommodated 22 per cent of the total school population. In Newfoundland 87 per cent of all schools were in this category, accommodating 57 per cent of all pupils.1/

1/ For a discussion of the inadequacies of small schools _see_ Newfoundland and Labrador (1967) and Downey (1965).

TABLE 2-24

Per Cent Change in School Organization, 1960-66

Province or Region	Boards	Schools	Classrooms	Teachers	Pupils
	%	%	%	%	%
Newfoundland	-12	-06	40	31	14
Prince Edward Island	-20	-15	30	36	17
Nova Scotia	-21	-34	27	21	12
New Brunswick	-28	-29	23	18	13
Atlantic	-22	-22	29	23	13
Manitoba	-43	-28	53	26	22
Saskatchewan	-19	-46	32	26	17
Alberta	-	11	56	39	28
British Columbia	-	14	56	43	39
Western	-23	-20	50	35	28

Source: Table 2-23.

If all schools of less than six rooms were to be replaced with classrooms in centralized schools, with an average enrolment of 20 pupils, it would be necessary to build 1,150 classrooms in Nova Scotia and 2,764 in Newfoundland. This would be the equivalent of 77 fifteen-room schools in Nova Scotia and 184 fifteen-room schools in Newfoundland. Using an estimate of \$20,000 per classroom, this building program would represent a cost of \$23 million for Nova Scotia and \$55 million for Newfoundland. The estimate of cost is based upon an analysis of costs in Alberta over a three-year period, and represents an average cost for both elementary and secondary schools and includes all ancillary space such as libraries, gymnasiums, offices, etc., and some landscaping. To replace all schools of eight rooms or less would cost Nova Scotia an estimated \$65 million, and Newfoundland \$82 million.

This basis of estimating centralization needs was not used for either New Brunswick or Prince Edward Island as the departments of education in these provinces already had preliminary plans for centralization drawn up. Using the number of classrooms provided for in these plans, and an estimate of \$20,000 per classroom, the capital cost in New Brunswick would be \$55 million and in Prince Edward Island \$12 million, to carry out their programs. If these estimates are combined with the estimated replacement costs of schools of less than six rooms in Nova Scotia and Newfoundland, a total of \$145 million would be required to provide a minimum centralization of education facilities in the Atlantic Provinces.

Summary

This section has compared the inputs of the education systems of the Atlantic Provinces with those of the Western Provinces in terms of pupils, teachers, expenditures, and school organization. It has shown the growth which has taken place in education need in all provinces during the last decade and indicated that this need for education may be beginning to level off with the falling birth rates, though increased school retention rates may tend to offset this trend. The higher birth rates in the Atlantic Provinces have resulted in a higher ratio of school-age population to working-age population resulting in a greater education need in that region than in the Western Region.

Education load, in terms of the proportion of the total population enrolled in public schools, has been somewhat greater in the Atlantic Region. In both regions education load has shown a very marked increase in the last 15 years, particularly at the secondary level. There are some differences in distribution of the load among age levels, with some provinces having a higher percentage of five-year-olds in preprimary classes, whereas other provinces had a higher representation of the 15-19 age group in high school.

Expenditures on education per pupil and per capita were considerably lower in the Atlantic Region. Expenditures per pupil ranged from $216 in Newfoundland to $581 in British Columbia, and expenditures per capita from $57 in Newfoundland to $124 in Alberta. These differences reflected differences in teacher salaries and other operating costs. The median salary for elementary teachers in the Atlantic Region was $1,700 below that of the Western Region, and the median salary for secondary teachers $1,900 below. This differential may be accounted for in part by lower teacher qualifications, and in part by lower wage scales in the Atlantic Provinces.

A limited examination was made of factors relating to school organization with particular emphasis on school district reorganization and centralization of school facilities. The capital investment necessary to replace the large number of small schools by more adequate centralized units is of the order of $145 million.

3. INTERPROVINCIAL DIFFERENCES IN OUTPUTS

The measurement of educational output is one of the most difficult problems in educational research.1/ This is due in part to the generality and complexity of education goals, in part to the problems of differentiating between those learnings which can be attributed to schooling and those gained elsewhere, and in part to the difficulties of developing valid and reliable measures of those outcomes of education which can be specifically defined and isolated. Because of provincial autonomy in educational matters, each province in Canada has independently determined its own standards and evaluative practices. This makes any interprovincial comparisons of education output both difficult and hazardous.

A traditional feature of Canadian school systems has been the external examination prepared and marked at the provincial level. At one time such examinations were common at every grade level from the completion of elementary schooling to high school leaving. During the past few decades, however, considerable modification of this procedure has taken place. Nevertheless the practice still prevails of holding provincial examinations at the termination of the high school program either to set matriculation standards for university entrance, or to determine levels of attainment for a general high school diploma. The grade level at which these examinations are given varies from province to province according to the length of the high school program. In some provinces this program terminates at Grade 11, in others at Grade 12, and in still others at Grade 13. Practices also vary among provinces with regard to external examinations at grades below high school leaving.

One measure of educational output sometimes used in Canadian studies has been graduation rates at the "junior matriculation" level. Some suggestion of the measurement of quality as well as quantity of output is implied in the use of this measure. A number of difficulties arise, however, with the use of this indicator. Many provinces no longer use the standard called "junior matriculation" and have neither external nor internal examinations to mark it. As it is commonly applied it refers to different grade levels in different provinces. In Nova Scotia and Alberta, for example, "junior matriculation" is designated as Grade 11 while in New Brunswick and British Columbia it is Grade 12. British Columbia has a Grade 13 which is considered to be "senior matriculation", hence Grade 12 is accepted as "junior matriculation". Alberta, on the other hand, which terminates secondary education with Grade 12, has designated it as "senior matriculation" and Grade 11 as "junior matriculation". Yet is is very common for Grade 12 students in

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1/ For a discussion of the problems associated with a productivity index for education see Benson (1961): p. 351-353.

Alberta to take two years to complete that grade, thus many have in effect a 13th year. This is illustrated by the fact that there were 1,407 more students in Grade 12 than in Grade 11 in 1965 in that province. Normally a considerable dropout might have been expected between these grades.

For the purposes of making interprovincial comparisons in this study the measure of education output used will be the retention rate of students to Grade 11. Grade 11 is selected because it marks the last year of high school in Newfoundland, and because students may be admitted to university in some provinces after reaching this standard. Retention rate is a measure of the holding power of the school and represents the years of schooling attained by school leavers. Years of schooling is a measure often used by economists in estimating the stock of education in the labour force. It is a readily obtainable, objective measure of education output which can be applied on an international, interprovincial, or subprovincial scale. It is, admittedly, a very rough indicator of the quantitative aspects of the productivity of education systems, and gives no indication of its qualitative aspects.

Pupil Retention Rates

Using a cohort survival method, the Education Division of the Dominion Bureau of Statistics has carried out two national studies of pupil retention rates.[1] The first study, published in 1960, followed selected eight-year-old cohorts in 1948-49 through the school systems to 1958-59. In the second study, published in 1965, similar cohorts were followed through the schools in the period from 1951-52 to 1963-64. The major findings of these studies, as they relate to the provinces of the Atlantic and Western Regions, are presented by means of line graphs in Figures 2-9 and 2-10. These figures illustrate the considerable improvement in retention rates attained by all provinces in the interval between these studies. They also indicate quite clearly that the holding power of the schools in the Atlantic Provinces was considerably below that of the schools in all the Western Provinces in both studies. This finding conforms with data already presented in Table 2-7, column (d), which showed a higher percentage of the 15-19 age group in school in the Western Region than in the Atlantic Region.

Using Grade 11 as a cut-off point, for reasons already stated, Figure 2-11 illustrates the differences in retention rates among the provinces of the two regions as reported in both studies. The improvement already noted during the six-year interval was more marked in some provinces than in others. In the Atlantic Region, New Brunswick showed the greatest improvement

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1/ Dominion Bureau of Statistics. Student Progress Through the Schools by Grade, 1960; and Student Progress Through the Schools, by Age and Grade, 1965.

FIGURE 2-9

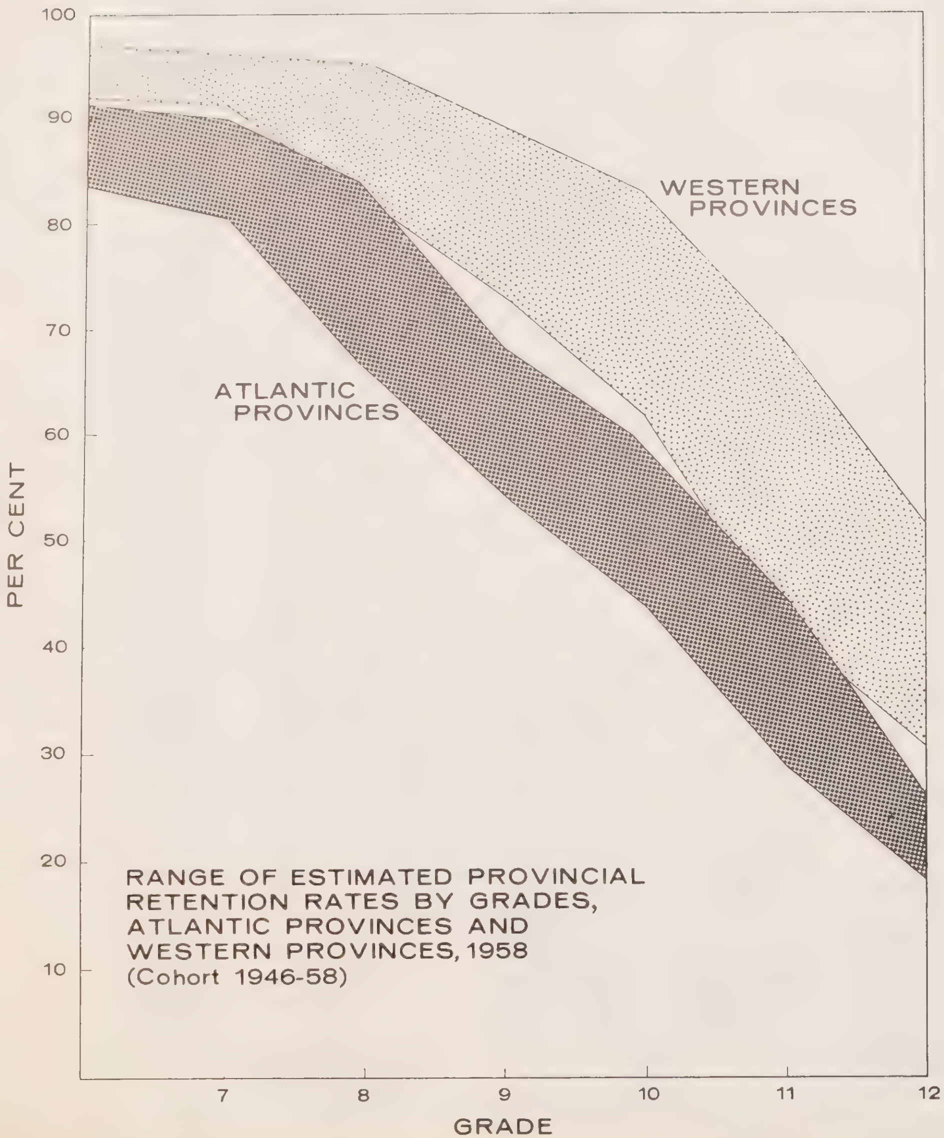


FIGURE 2-10

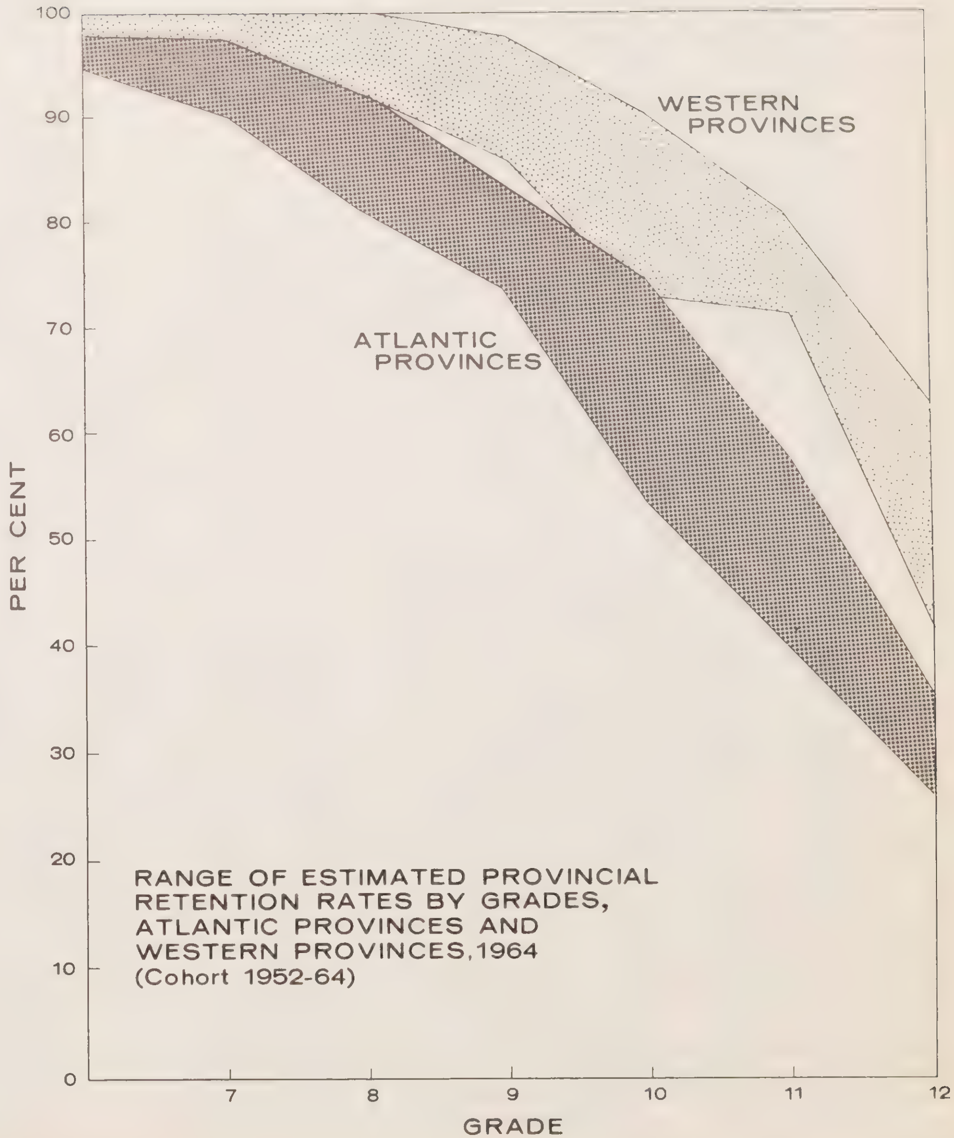
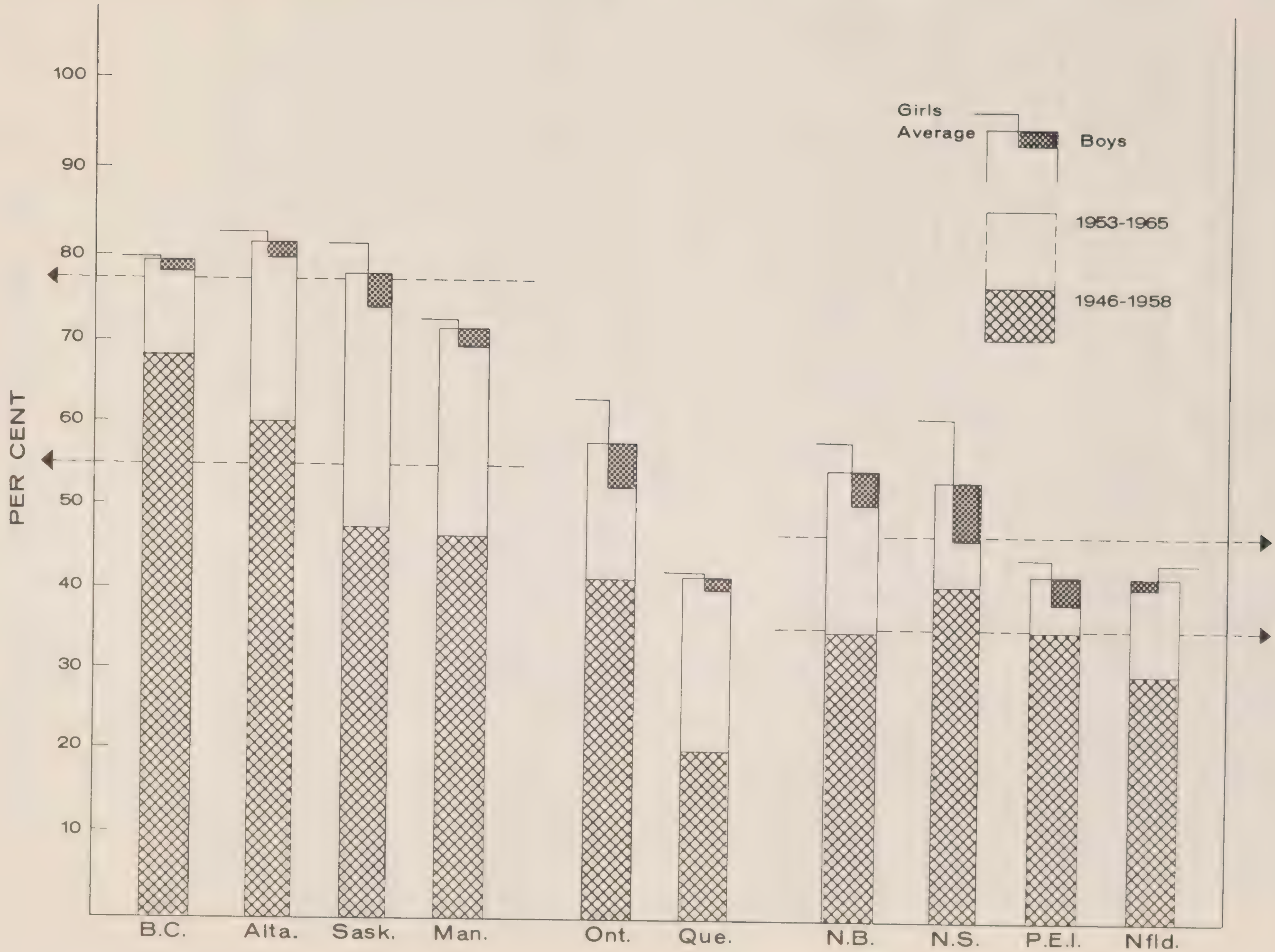


FIGURE 2-11

Estimated Retention Rate, Grade 2 to Grade 11



in retention rates, Prince Edward Island the least. Among the Western Provinces, Saskatchewan had the highest rate of increase, British Columbia the lowest. However, there continues to be a very wide range in retention rates among provinces, though there is some indication that this may be narrowing.

In the second study the estimated retention rates are given for boys and girls separately. From a labour force standpoint, a significant fact illustrated in Figure 2-11 is that a higher percentage of girls are retained to Grade 11 than boys in all provinces except Newfoundland. The difference between retention rates of boys and girls is particularly marked in Nova Scotia where it reaches 14 percentage points. In that province 60 per cent of the girls were retained but only 46 per cent of the boys. In New Brunswick the retention rate for boys was 50 per cent and for girls 57 per cent; in Prince Edward Island it was 38 per cent for boys and 43 per cent for girls. In Alberta 80 per cent of the boys were retained and 82 per cent of the girls; while in British Columbia 78 per cent of the boys and 79 per cent of the girls were retained to Grade 11. Table 2-25 reports the figures for boys and girls separately at each grade level.

TABLE 2-25

Estimated Retention Rate by Grades, 1952-54 to 1964-65

Province	2		6		7		8		9		10		11		12		13	
	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G	B	G
Newfoundland	100	100	95	98	89	93	81	86	68	72	51	54	43	40				
Prince Edward Island	100	100	94	96	92	91	80	82	66	73	59	73	38	43	28	29		
Nova Scotia	100	100	96	97	94	96	88	93	80	85	69	81	46	60	24	27		
New Brunswick	100	100	99	100	98	100	89	94	84	82	62	68	50	57	29	36		
Qué. RC	100	100	92	96	88	92	80	76	67	65	47	48	38	37	10	7		
Pr.	100	100	100	100	87	91	74	70	74	70	70	69	54	58	6	4		
Ontario	100	100	100	100	100*	100*	94*	100*	92*	98*	73‡	81‡	52‡	62‡	48‡	54‡	24#	28#
Manitoba	100	100	95	95	90*	93*	90*	93*	85	86*	73	72	72	71	46	40		
Saskatchewan	100	100	100	100	100	100	98	100	97	99	82	83	74	81	64	62		
Alberta	100	100	100	98	100	96	97	92	93	91	81	83	80	82	54	50		
British Columbia	100	100	100	100	100	100	100	100	96	95	89	90	78	79	64	62	12	8

* Formula method.

‡ Based on Annual Report of the Minister of Education.

\# Based on grade factor (3-year average).

B = Boys
G = Girls

Source: D.B.S. Student Progress Through the Schools by Age and Grade, 1965, p. 13.

An examination of Table 2-26, which reports retention rates of boys and girls by age, reveals that in Nova Scotia 49 per cent of the boys age 17, and 45 per cent of the girls of that age, were retained in school. Similarly in New Brunswick 45 per cent of the boys age 17, and 39 per cent of the girls, were retained. These data would seem to contradict the findings reported in the previous table, 2-25. The explanation lies in the differences in retardation rates between boys and girls which are reported below. While more boys may be retained than girls they do not achieve the same grade level before dropping out.[1]

TABLE 2-26

Estimated Retention Rate by Age in Elementary and Secondary Schools

(Cohort Survival Technique)

Province	7	13	14		15		16		17		18	
			B	G	B	G	B	G	B	G	B	G
Nfld.	100	100	98	99	88	87	68	62	40	27	17	8
P.E.I.	"	"	93	97	80	85	68	78	38	42	18	16
N.S.	"	"	98	96	88	89	72	72	49	45	26	16
N.B.	"	"	97	96	83	83	64	65	45	39	21	11
Qué. RC	"	"	84	76	68	60	53	40	30	15	12	3
Pr.	"	"	98	93	90	82	63	54	36	22	11	10
Man.	"	"	92	94	87	88	78	77	59	49	33	16
Sask.	"	"	100	100	92	94	84	84	65	58	28	15
Alta.	"	"	98	97	92	92	81	80	61	52	31	18
B.C.	"	"	98	100	98	98	95	93	83	82	60	47

NOTE: Ontario data not available.

Source: D.B.S. Student Progress Through the Schools by Age and Grade, 1965, p. 23.

1/ A report of some international studies of failures and drop-outs is given by Ferrez (1961).

Pupil Retardation Rates

The facts just presented relative to the differences between sexes in retention rates lead to an examination of differences in retardation rates. Retardation is related to school failure and is defined in this study as being one year or more older than the modal group for any grade. For example, the modal group for Grade 3 would be age eight. Any pupil in that grade who was 10 years old would be considered as one year over-age in grade, an 11-year-old would be considered as two years over-age in grade. This definition allows for differences in school starting age due to birth dates, but in so doing actually underestimates the retardation rate. Figure 2-12 presents, for each of the provinces in the two regions except British Columbia,1/ the percentage of students one year or more over-age in grade.

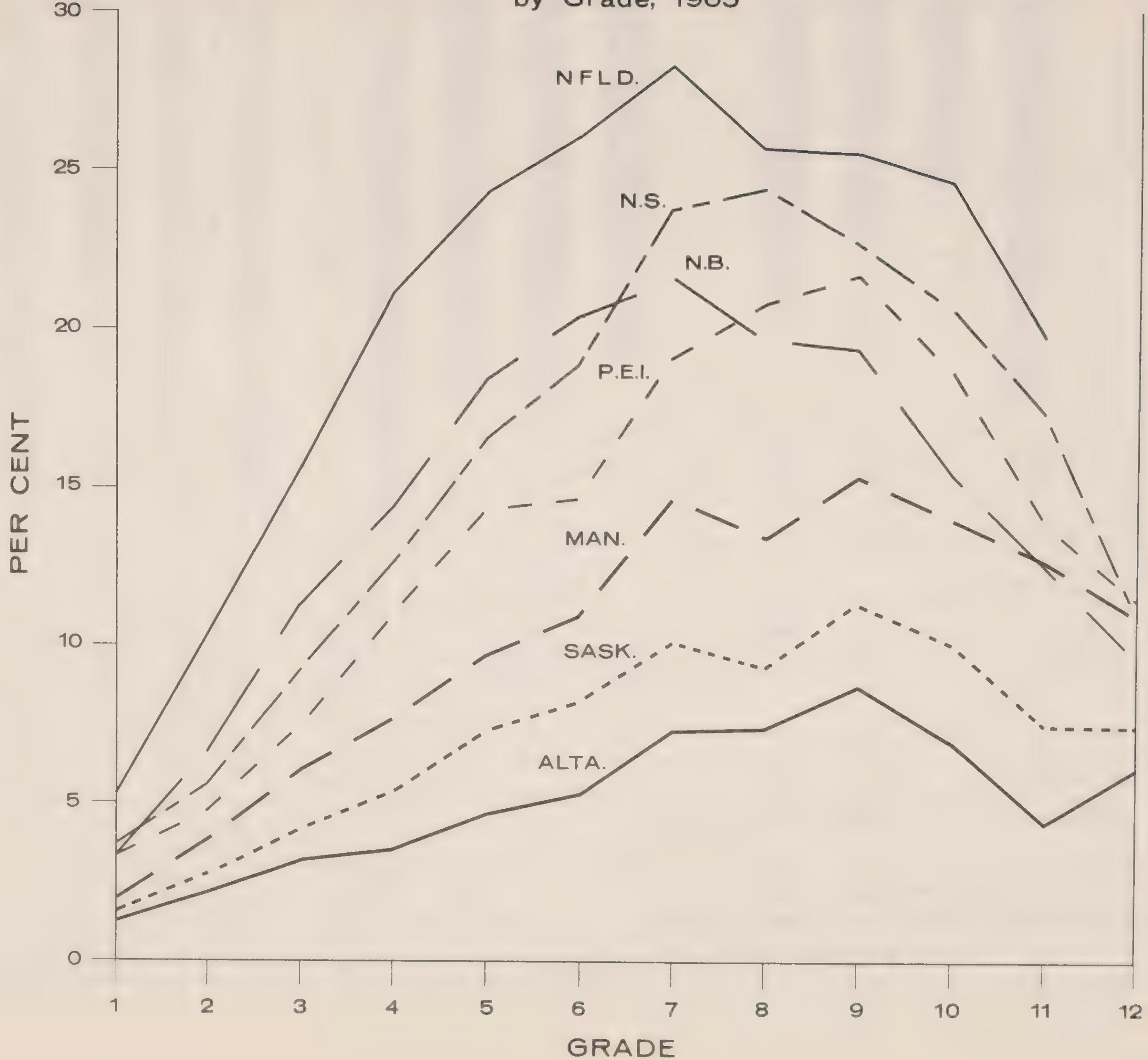
It is readily apparent that the retardation rates are very much higher in the provinces of the Atlantic Region than in the Western Region. It should also be noted that the retardation graphs for the Atlantic Provinces peak at an earlier grade level than do those of the Western Provinces. This peak marks the grade at which pupils who are over-age in grade begin to drop out of school. Had they not left school the graph would continue to rise or at least remain on a plateau. After Grade 9 there is a fall-off in retardation rates in all provinces indicating that some pupils in this category, having reached the legal leaving age, are dropping out.

The per cent of Grade 7 pupils over-age in grade is shown in Figure 2-13. For the provinces of the Atlantic Region retardation rates in 1961 are compared with those in 1965. No general pattern of change is apparent. Retardation rates dropped in Newfoundland and New Brunswick, remained about the same in Nova Scotia, and increased in Prince Edward Island. The bar graphs in this figure also indicate the proportions of those one year behind their age group and those more than one year. Rates for boys and girls are indicated separately. In some provinces almost half have experienced two or more years of failure. The percentage in the over-age category would appear to be higher in the Atlantic Provinces than in the Western Provinces. In the Atlantic Region as a whole, the retardation rates for boys are about double those for girls at the Grade 7 level. The percentage two years or more over-age in grade in these provinces is also higher for boys than for girls.

1/ British Columbia is omitted only for the sake of pictorial clarity since its line would fall between or overlap those of Manitoba and Prince Edward Island.

FIGURE 2-12

Per Cent of Pupils One or More Years Over-Age in Grade, by Grade, 1965



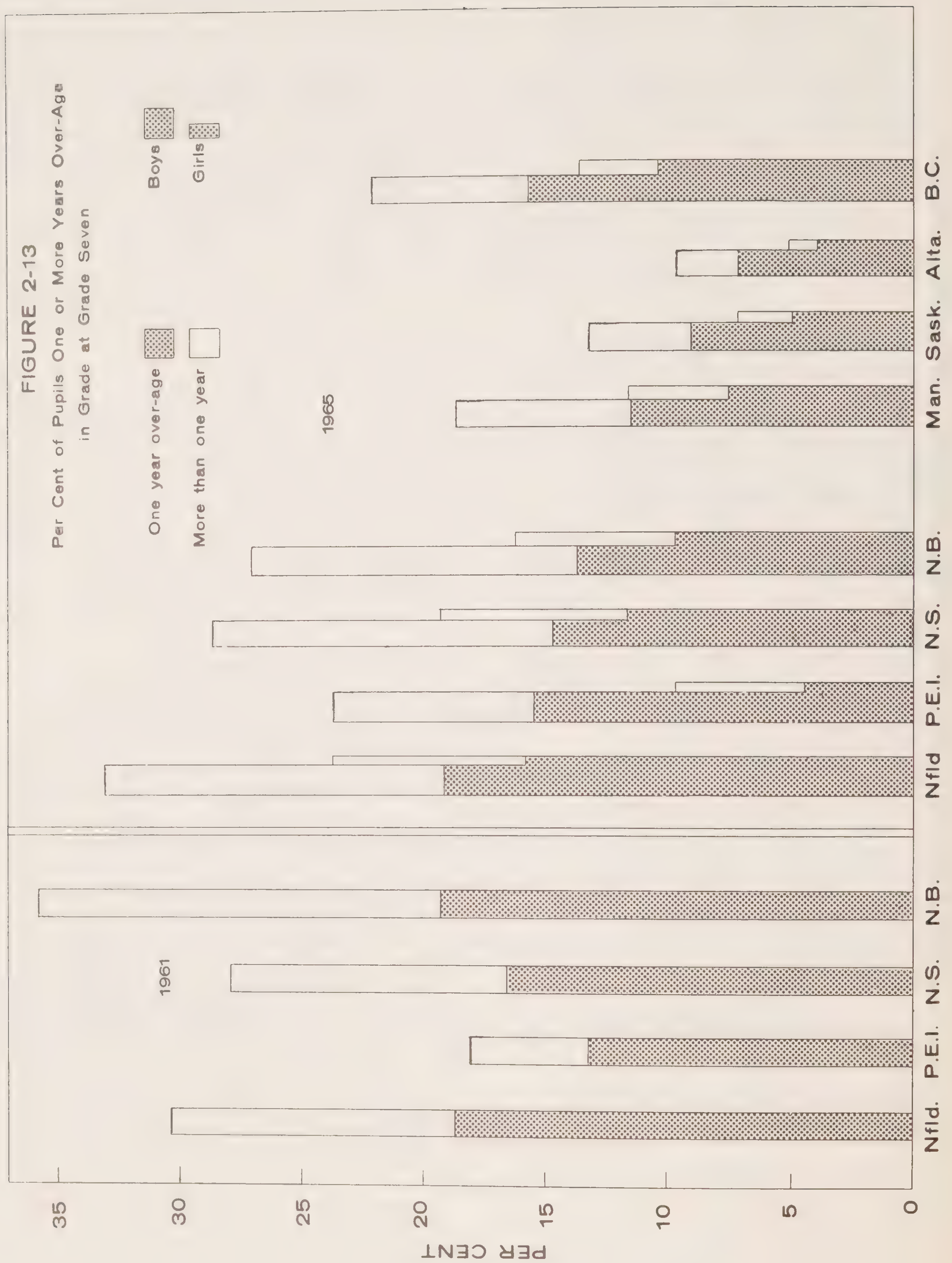


FIGURE 2-13

Per Cent of Pupils One or More Years Over-Age in Grade at Grade Seven

TABLE 2-27

Percentage of Grade Enrolment that is Repeating the Grade
(Calculated from data for school years 1961-62 to 1963-64)

Province	Sex	Grade								
		2	3	4	5	6	7	8	9	10
Newfoundland	B	16	14	13	13	9	11	10	24	20
	G	10	8	10	9	6	8	8	25	15
Prince Edward Island	B	7	6	5	7	6	6	12	10	10
	G	2	5	2	4	2	4	12	10	10
Nova Scotia	B	10	11	12	11	11	15	10	9	9
	G	6	6	7	7	9	11	7	5	4
New Brunswick	B	9	7	7	9	6	8	4	3	2
	G	5	5	4	5	4	5	4	2	1
Manitoba	B	10	8	7	8	7	12	4	10	5
	G	6	5	5	6	6	9	4	7	5
Saskatchewan	B	8	6	4	5	3	5	2	3	0
	G	4	3	2	3	2	3	1	3	0
Alberta	B	6	5	4	3	2	5	3	4	0
	G	3	2	2	3	3	6	7	7	0
British Columbia	B	7	5	3	3	2	4	7	8	2
	G	4	3	2	3	2	3	5	6	2

Source: D.B.S. Student Progress Through the Schools, by Age and Grade, 1965, p. 11.

The figure just considered presents the cumulative effects of retardation to the Grade 7 level only. For Newfoundland and New Brunswick this grade represented the peak of retardation rates, for other provinces it would be Grade 8 or 9. In Table 2-27 will be found a D.B.S. estimate of the percentage of each grade enrolment that was repeating the grade, based on data for 1961-62 to 1963-64. Grade 1 is omitted for this table, though retardation is widely practised at this level to compensate for lack of readiness for learning at the time of entering school. In 1964-65, 14 per cent of the Grade 1 pupils in Newfoundland, New Brunswick, and Prince Edward Island were repeating the grade. In Nova Scotia, 7 per cent were repeating. In each case about 60 per cent of the repeaters were boys. This higher failure rate for boys continues at each grade level until Grade 8 when some of the failures have dropped out of school. This distinction in failure rates between boys and girls disappears after Grade 4 in Alberta.

When this picture of retardation rates is coupled with the picture previously presented of retention rates, the serious implications of retardation policies for education output become apparent.

> There is probably no school system in the world which is not in one way or another concerned about a proportion of pupils who fail. Such failure, as studies in the past fifty years have repeatedly shown, is costly in terms of the efficiency of the school system itself. This is not to say that all failure is to be avoided or indeed that it can be. We do, however, need to know just what the extent of the problem may be in any school system and we should be in a position to go some way toward so controlling it that there be waste neither of teaching time and effort nor of the human capital represented by the failing pupils. (Wall and Olson, 1962.)

Perhaps more serious even than the cost of failure to the school system is the cost of failure to the pupil himself. "Competent observers, who have made an astute assessment of what has happened recently, see failure as the fundamental reason for violent discontent - failure as evidenced by poverty, slums, unemployment, racial tensions, abysmal insecurity and what have you." (Campbell, 1967.)

Associations Among Inputs and Outputs

The association between expenditures on elementary and secondary education per pupil, and retention rate to Grade 11, is shown in Figure 2-14. In this figure the retention rates of the two cohort studies are plotted against expenditures for 1956 and 1962. A very high association is shown. In Figure 2-15 median salaries of teachers are plotted against retention rates, showing a still higher correlation with the results of the two studies. By plotting the results from two studies in this manner, comparisons can be made on a longitudinal basis for each province. It is clearly apparent that expenditures on education, particularly as expressed in teacher salaries, correlate very highly with retention rate. Teacher salaries, as has been pointed out, reflect both differences in qualifications and scale differences among provinces. It is difficult to compare teacher qualifications using only a single measure; however, in Figure 2-16 retention rates from the two studies are plotted against the per cent of teachers with minimal training qualifications. Again a correlation results.

It is well known that association does not necessarily imply causation. There appears to be little doubt, however, that improvement in teacher qualifications is an important factor in the improvement of retention rates. A high correlation is also found between retardation rates and expenditures on

FIGURE 2-14
Association of Expenditure Per Pupil with Retention

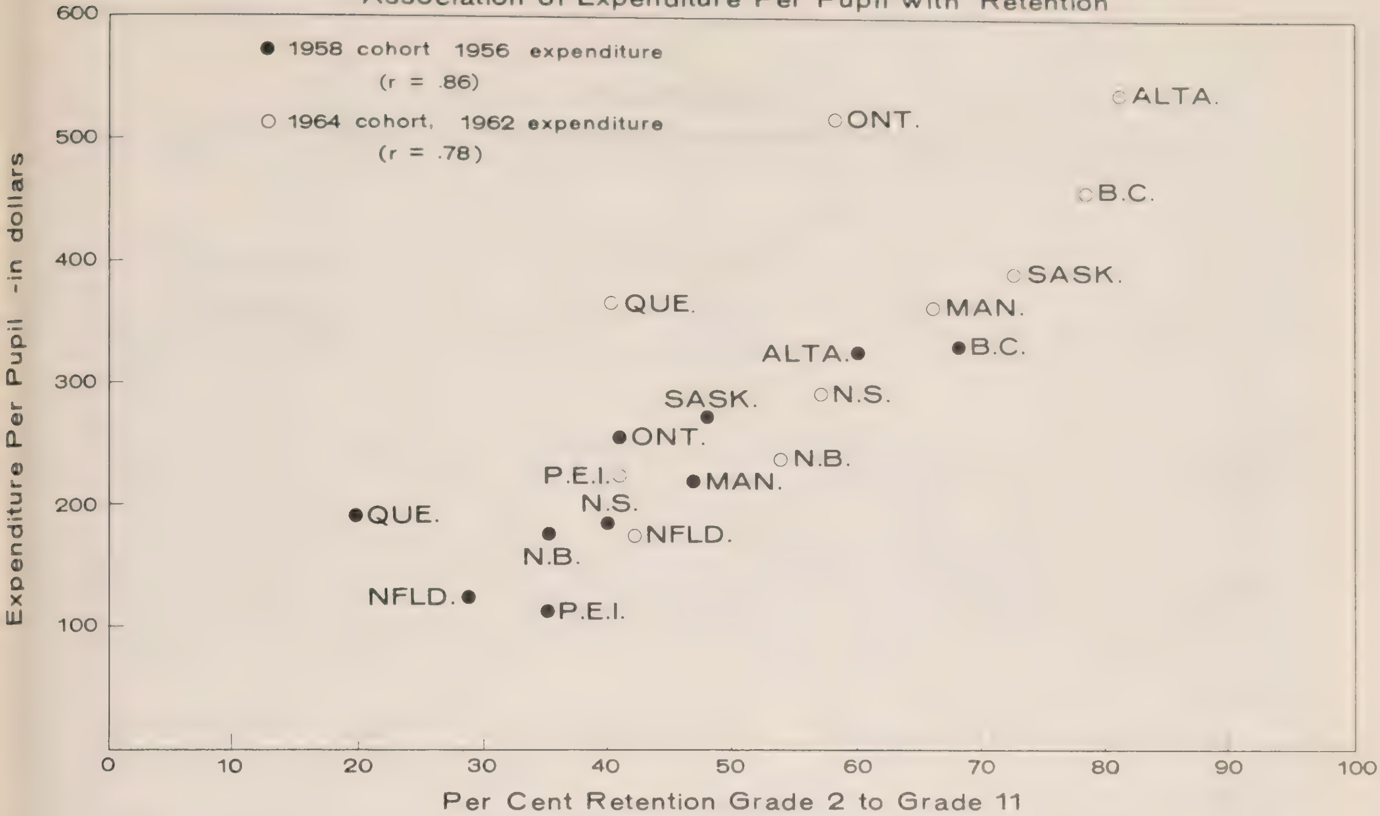


FIGURE 2-15
Association of Teachers' Salaries with Retention

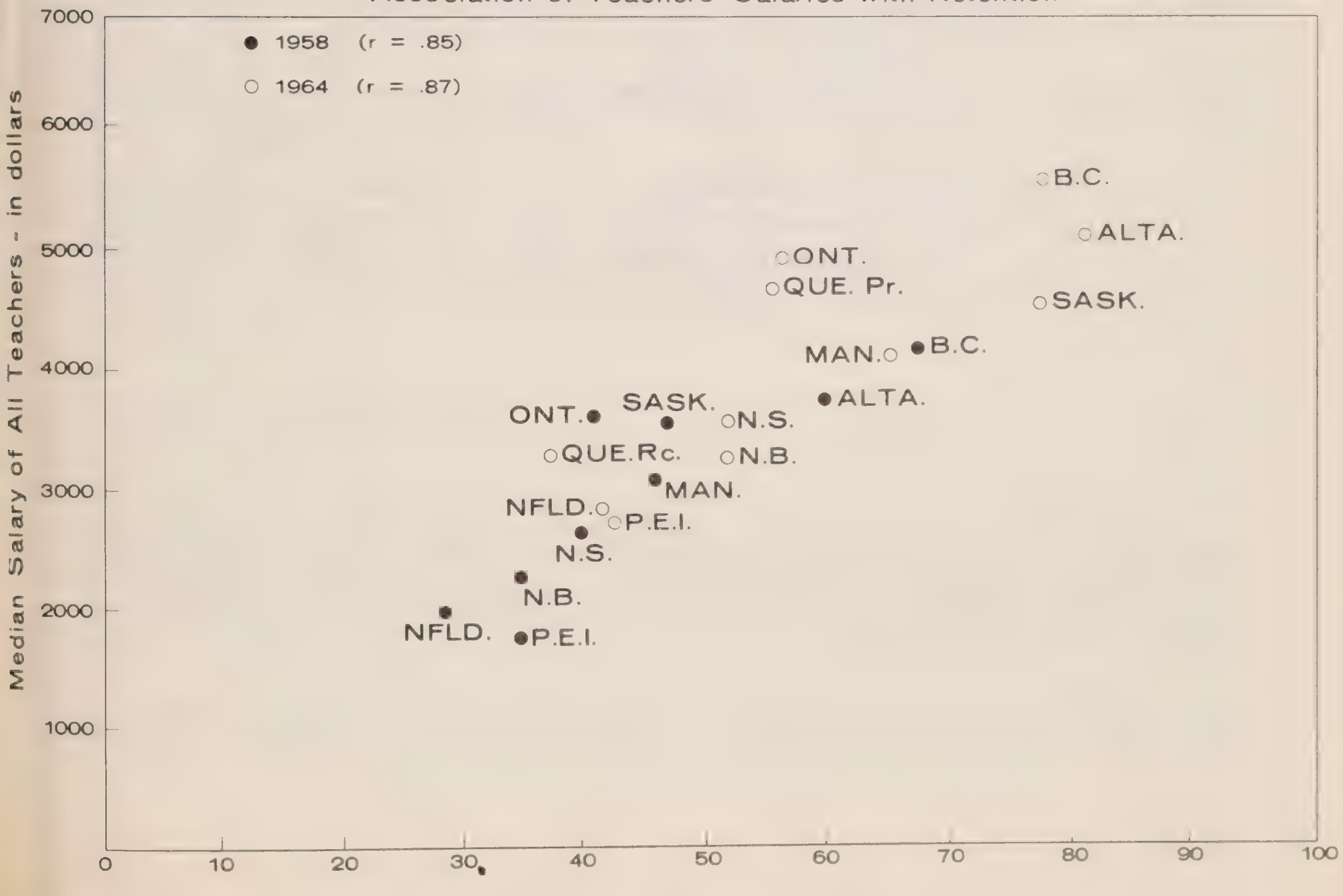
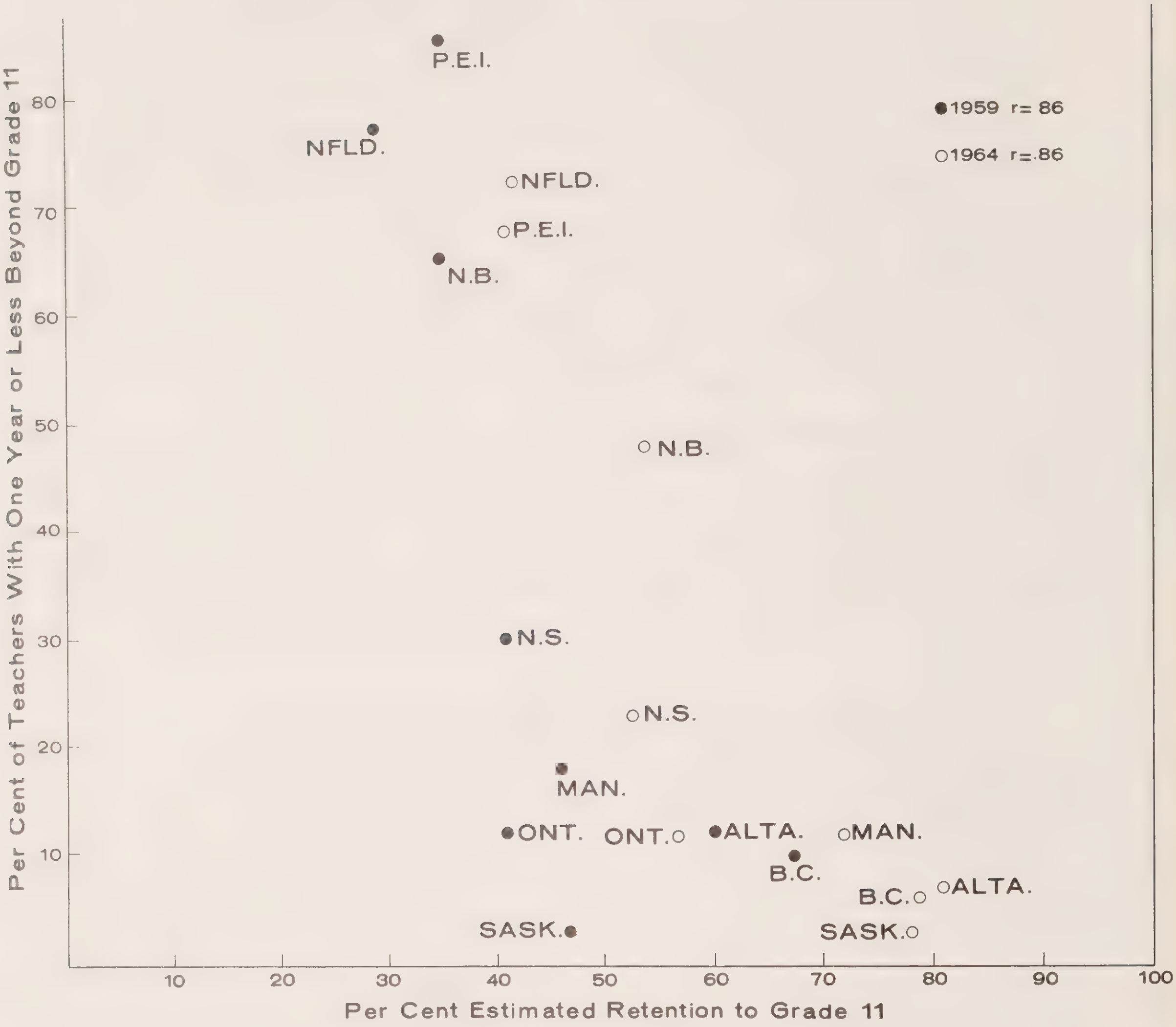


FIGURE 2-16

Association of Teacher Qualifications with Retention



education and, as would be expected, between teacher salaries and qualifications and retardation rates. Those provinces with better trained teachers have a lower retardation rate and a higher retention rate.

4. SUMMARY

In this section the findings relative to the inputs and outputs of the educational systems of the Atlantic and Western Regions of Canada are outlined in summary form.

Pupil Population

In the Atlantic Region the Percentage Increase in Population from 1956-1966 was Approximately Half that of the Western Region.

The Atlantic Region experienced a total population increase of approximately 12 per cent during the 1956-1966 decade, compared with an increase of about 24 per cent for the Western Region. Within the Atlantic Region, Newfoundland experienced the highest rate of increase: 19 per cent, and Nova Scotia the lowest: 9 per cent. The percentage increases for New Brunswick and Prince Edward Island were 11 and 9 per cent, respectively.

Educational "Need" is Greater in the Atlantic Provinces than in the Western Provinces.

Educational "need", defined as the ratio of the weighted school-age group (5-19) to the working-age group (20-64), is greater for the Atlantic Region than for the Western Region. In 1965 the ratio for the Atlantic Region was .88 and for the Western .71. This represented an increase from the 1961 Census of .15 for the Atlantic and .15 for the Western Region. Within the Atlantic Region, there was a range from .79 for Nova Scotia to 1.02 for Newfoundland.

The average number of children per family in 1961 was 2.24 in the Atlantic Region, 1.74 in the Western. Within the two regions Newfoundland had the highest average (2.67), New Brunswick the second highest (2.28), and British Columbia the lowest (1.59).

The Atlantic Region Experienced a One-Third Increase in Total School Population During the Decade 1956-1966.

The increase in total school population for the Atlantic Region from 1956 to 1966 was 32 per cent, for the Western Region it was 53 per cent. The range in the Atlantic Region was from 27 per cent in Nova Scotia to 42 per cent in Newfoundland. New Brunswick and Prince Edward Island each had an increase of about 30 per cent.

In 1956, 23 per cent of the total population of the Atlantic Region was enrolled in elementary or secondary schools. By 1966

the percentage had increased to 27 per cent. In the Western Region the percentage of the population in school in 1956 was 19 per cent; in 1966, 23 per cent.

Secondary School Enrolments Doubled in the 1956-1966 Decade.

By far, the largest enrolment increases were in the secondary schools (Grades 9-12). New Brunswick experienced an increase of 168 per cent and Newfoundland an increase of 106 per cent. The increase for Prince Edward Island was 79 per cent and for Nova Scotia 76 per cent. The percentage increase in secondary school enrolments for the Atlantic Region during the 1956-1966 decade was 93 per cent. The Western Region experienced an increase of 96 per cent during the same period, all provinces but Saskatchewan having increases of over 100 per cent.

The highest secondary school enrolment increase relative to the elementary enrolment increase during the decade was in New Brunswick. Elementary school enrolments increased only 18 per cent whereas secondary enrolments increased 168 per cent. For the Atlantic Region as a whole, elementary school enrolments increased by 22 per cent.

Expenditure Patterns

Total Expenditures on Elementary and Secondary Education in the Atlantic Region Increased by 68 per cent on a Per-Capita Basis, or 50 per cent on a Per-Pupil Basis, During the Six-Year Period from 1959 to 1965.

During this period the percentage increase in total expenditures, on a per-capita basis, was 68 per cent for the Atlantic Region, 62 per cent for the Western. The greatest percentage increase occurred in Prince Edward Island - 113 per cent. On a per-pupil-in-average-daily-attendance basis, the percentage increase was 50 per cent for the Atlantic Region, 36 per cent for the Western. Prince Edward Island had an increase on this basis of 78 per cent, Nova Scotia 44 per cent, New Brunswick 41 per cent, and Newfoundland 42 per cent.

Expenditure Levels on Elementary and Secondary Education in the Atlantic Region were 40 per cent Below those of the Western Region on a Per-Capita Basis, and 45 per cent Below on a Per-Pupil Basis in 1965.

Although the Atlantic Provinces had higher percentage increases in expenditures than the Western Provinces during the 1959-1965 period, a large dollar gap in expenditures persisted. In 1959 the differential was $30 per capita, $194 per pupil. In 1965 it was $46 per capita, $237 per pupil. In the latter year, per-capita expenditures for the Atlantic Provinces averaged $69,

for the Western Provinces $115. Per-pupil expenditures averaged $286 for the Atlantic Provinces, $523 for the Western Provinces.

The Range of Expenditures among Individual Provinces within the Two Regions Continues to be very Wide.

Nova Scotia, the highest expenditure province in the Atlantic Region, had per-capita expenditures 47 per cent, or $21, higher than Newfoundland - the lowest-expenditure province. Per-pupil expenditures in Nova Scotia were 55 per cent, or $118 higher than in Newfoundland. Alberta's per-capita expenditures were 118 per cent, or $67, higher than those of Newfoundland; 55 per cent, or $44, higher than those of Nova Scotia. On a per-pupil basis the differential between British Columbia and Newfoundland in 1965 was 169 per cent, or $320, and between British Columbia and Nova Scotia 74 per cent, or $247.

From 1956 to 1965 the dollar gap between Newfoundland and Nova Scotia, on a per-pupil basis, increased from $51 in 1956 to $56 in 1959, to $80 in 1962, and to $118 in 1965. Between Nova Scotia and British Columbia the differential was $160 in 1956, $187 in 1959, $161 in 1962, and $247 in 1965.

In 1967 Capital Expenditures Accounted for Approximately 14 per cent of Total School Board Expenditures in the Atlantic Region; Teacher Salaries, Approximately 64 per cent.

In the Western Provinces teacher salaries accounted for 57 per cent of total expenditures. The range for the two regions was from 53 per cent in Saskatchewan to 65 per cent in Newfoundland.

As a percentage of operating costs salaries accounted for 74 per cent in the Atlantic Region, 67 per cent in the Western Region. The range was from 64 per cent in Saskatchewan to 75 in Newfoundland.

Median Salaries of Both Elementary and Secondary Teachers in the Atlantic Region are Below the Canadian Median.

In 1966-67 the median salaries of Canadian elementary teachers ranged from $3,315 in Newfoundland to $6,020 in British Columbia. Nova Scotia, with a median of $3,954 - the highest among the Atlantic Provinces - was $639 above the Newfoundland median. The greatest difference was found in the case of male elementary teachers for whom the median in Newfoundland was $3,380, in British Columbia $6,717, a difference of $3,337 or nearly 100 per cent.

The median for secondary teachers in 1966-67 ranged from $4,706 in Prince Edward Island to $7,819 in British Columbia. Nova Scotia had a median of $6,026 for secondary teachers - $1,320 above the median for Prince Edward Island.

Salary scales incorporate two major dimensions: levels of training and years of experience. In some instances length of tenure with the employing school board may influence placement in terms of years of experience.

Between the average salaries of beginning elementary teachers with lower levels of training (1-3 years beyond junior matriculation) a differential of approximately $800 existed in 1966-67 between the Atlantic and Western Regions. For beginning elementary teachers with 4-7 years training the differential was approximately $675. For elementary teachers with 4-9 years of experience the differential between regions was approximately $1,050 at the lower levels of training and $950 at upper levels.

At the secondary level the average salary of beginning teachers with lower levels of training was approximately $3,500 for the Atlantic Region and $4,200 for the Western. For beginning secondary teachers with upper levels of training a similar differential existed. For experienced teachers the differential rose to about $1,400 for lower levels of training and $1,200 for higher levels.

Teacher Qualifications

In Addition to Salary Scale Differences, Expenditures on Teacher Salaries Reflect Differences in Qualifications.

Three aspects of teacher qualifications were examined: levels of training, years of experience, and tenure with the same school board. It may be hypothesized that there is a relationship between the effectiveness of teachers generally and the training they have received; the experience they have gained; and the period of time they have worked for a particular school system.

The Percentage of Teachers with Degrees, at Both the Elementary and Secondary Levels, is Considerably Lower for the Atlantic Region than for the Western Region.

In 1966-67, 23 per cent of all teachers in the Atlantic Region held a university degree compared with 38 per cent for the Western Region. Of the elementary teachers, 10 per cent held degrees in the Atlantic Region, 18 per cent in the Western Region. The range extended from 3 per cent in Prince Edward Island to 25 per cent in British Columbia. The percentage for Nova Scotia was 16, for New Brunswick 8, and for Newfoundland 6.

Of the secondary teachers in the Atlantic Region, 55 per cent held university degrees in 1966-67 compared with 70 per cent in the Western Region. The range extended from 46 per cent in Newfoundland to 75 in British Columbia. In Nova Scotia the percentage was 65.

From 1961 to 1967 the percentage point increase in teachers with degrees was 6.9 for the Atlantic Region, 11.4 for the Western. The range extended from Newfoundland, with an increase of 4.6, to Alberta with an increase of 13.8 percentage points.

Half the Elementary Teachers in the Atlantic Provinces had One Year or less of Training Beyond Junior Matriculation.

In 1966-67, 48 per cent of the elementary teachers in the four Atlantic Provinces had one year or less of training beyond junior matriculation. In the four Western Provinces only 9 per cent of the elementary teachers were reported in this category. The range extended from 4 per cent in Saskatchewan to 78 per cent in Newfoundland. In Prince Edward Island the percentage was 70, in New Brunswick 44, in Nova Scotia 25.

More than One Quarter of the Secondary Teachers in the Atlantic Provinces had Two Years or less of Training Beyond Junior Matriculation.

Of the secondary teachers in the Atlantic Region, 29 per cent had two years or less of training beyond junior matriculation in 1966-67. The percentage in the category for the Western Region was 14. The range extended from 7 per cent in Saskatchewan to 40 in New Brunswick. For Prince Edward Island the percentage was 36, for Newfoundland 38 and for Nova Scotia 13.

The Median Experience of Elementary Teachers in the Atlantic Provinces is Generally above the Median for all Canadian Teachers Except in the Case of Newfoundland.

In 1966-67 the median experience of elementary teachers in Nova Scotia was 10 years : 9 months, in New Brunswick 8:5 and in Prince Edward Island 8:7, and in Newfoundland 3:8. This represented an increase of about one year over the 1960-61 figures in three of the provinces, and three years in the case of Prince Edward Island, suggesting a general improvement in teacher retention. Nova Scotia had the highest median of the eight provinces, Newfoundland the lowest.

In Canada generally, and in the Atlantic Provinces in particular, there was a decrease in the median years of experience of secondary teachers from 1961 to 1967. The Atlantic median dropped by about 3:0, the Western by about 2:4. In Newfoundland the median dropped from 9:8 in 1961 to 7:0 in 1967, and in Prince Edward Island from 12:1 to 6:1. Nova Scotia had a decrease from 10:2 to 8:6, while New Brunswick dropped from 8:5 to 7:1.

The Median Tenure of Both Elementary and Secondary Teachers was Above the Canadian Median in Two of the Atlantic Provinces and Below the Median in Two Others.

Tenure is defined as years of experience in the same school district. In 1966-67 Nova Scotia had a median of 5:2 for elementary teachers, 3:5 for secondary. In New Brunswick the median tenure for elementary teachers was 3:7, for secondary teachers 3:2. Newfoundland, however, had a median of only 1:6 for elementary teachers and of 2:2 for secondary teachers. Prince Edward Island had a median for both elementary and secondary teachers of 2:2.

In the Atlantic Region Teacher Tenure is Generally Somewhat Lower for Secondary Teachers than for Elementary Teachers.

Except in Newfoundland the median tenure of secondary teachers in the Atlantic Provinces is a few months lower than for elementary teachers. The reverse is true in the Western Provinces.

School Organization

The Number of School Districts and Boards is Being Reduced in all Atlantic Provinces.

From 1960 to 1966 the number of operating school boards was reduced by 12 per cent in Newfoundland, by 20 per cent in Prince Edward Island, by 21 per cent in Nova Scotia, and by 28 per cent in New Brunswick. Plans are currently under consideration in all provinces for the reorganization of existing school sections or districts into larger units.

Although the Number of Schools in Operation has Decreased Since 1961 Many Small Schools Continue in Operation in all Atlantic Provinces.

In 1966 the average school size for the Atlantic Provinces was six teachers with 158 pupils. The average for the Western Provinces was 10 teachers with 250 pupils. The average number of pupils per classroom in each region was about 25.

Between 1960 and 1966 there was a decrease in number of operating schools of 6 per cent in Newfoundland, 15 per cent in Prince Edward Island, 34 per cent in Nova Scotia and 29 per cent in New Brunswick.

An Estimated $145 Million would be Required for Minimum Centralization of Schools.

If all schools of less than six rooms were to be replaced with classrooms in centralized schools, with an average enrolment of

20 pupils, it would be necessary to build 1,150 classrooms in Nova Scotia and 2,764 in Newfoundland. This would be the equivalent of 77 fifteen-room schools in Nova Scotia and 184 fifteen-room schools in Newfoundland. Using an estimate of $20,000 per classroom, this building program would represent a cost of $23 million for Nova Scotia and $55 million for Newfoundland. On the basis of preliminary plans of departments of education another $55 million would be required in New Brunswick and $12 million in Prince Edward Island.

Average Classroom Size is Similar in the Atlantic and Western Regions.

The average classroom size for the Atlantic Region in 1966 was 25.2 pupils and for the Western Region 24.9 pupils. The range in the Atlantic Region was from 23.0 in Prince Edward Island to 26.3 in Newfoundland. The range for the Western Region was from 23.5 in Alberta to 26.7 in British Columbia.

Pupil Retention

The Proportion of the 15-19 Age Group in School for the Atlantic Provinces was about 10 Percentage Points Lower than that of the Western Provinces in 1961.

At the time of the 1961 Census the percentage of 15-19 year old males in school in the Atlantic Provinces ranged from 52 per cent for Newfoundland to 57 per cent for Nova Scotia. The range for the Western Provinces was from 62 per cent for Manitoba to 69 per cent for British Columbia. For females the Atlantic Provinces had a range from 52 per cent in Newfoundland to 57 per cent in Nova Scotia, and the Western Provinces had a range from 62 per cent in Manitoba to 68 per cent in British Columbia.

Pupil Retention Rates in the Atlantic Provinces, Particularly for Boys, are much Lower than in the Western Provinces.

A 1965 study by the Dominion Bureau of Statistics revealed that pupil retention rates, particularly for boys, were about 30 percentage points lower in the Atlantic Provinces than in the Western Provinces. The retention of boys from Grade 2 to Grade 11 was reported to be 38 per cent for Prince Edward Island, 43 per cent for Newfoundland, 46 per cent for Nova Scotia and 50 per cent for New Brunswick. For the Western Provinces the percentages were: Manitoba 72, Saskatchewan 74, Alberta 80 and British Columbia 78. Retention rates to Grade 11 for girls in the Atlantic Provinces ranged from 40 per cent for Newfoundland to 60 per cent for Nova Scotia. In the Western Provinces the range for girls was from 71 per cent in Manitoba to 82 per cent in Alberta.

The Rate of Improvement in Retention was much Less in the Atlantic Provinces than in the Western Provinces over a Five-Year Period.

In an earlier study, reported in 1960, the retention rates to Grade 11 in the Atlantic Provinces were 29 per cent for Newfoundland, 35 per cent for Prince Edward Island and New Brunswick, and 40 per cent for Nova Scotia. At that time the retention rates in the Western Provinces ranged from 46 per cent in Manitoba to 68 per cent in British Columbia.

If boys' retention rates in the 1965 report are compared with the general estimate for both boys and girls in the earlier report, the percentage point increases in retention rates during the five-year period would be as follows: Newfoundland 14, Prince Edward Island 3, Nova Scotia 6, and New Brunswick 15. For the Western Provinces the increases were: Manitoba 26, Saskatchewan 27, Alberta 20 and British Columbia 10.

Pupil Retardation Rates

Retardation Rates in the Atlantic Region at Age 15 are Double those of the Western Region.

In 1965, 30 per cent of the 15-year-old pupils in schools of the Atlantic Provinces were one or more years over-age in grade. The percentage of 15-year-olds in this category in the Western Region was 15.

It is a general fact that the retardation rates of boys in all Canadian Provinces are much higher than for girls. In the Atlantic Provinces the rates for 15-year-old boys in 1965 were: Newfoundland 41 per cent, Prince Edward Island 33 per cent, Nova Scotia 36 per cent and New Brunswick 35 per cent. The range for boys in the four Western Provinces was from 12 per cent in Alberta to 26 per cent in British Columbia. Retardation rates for girls in the Western Provinces ranged from 7 per cent in Alberta to 16 per cent in British Columbia. In the Atlantic Provinces the rates for girls at age 15 were: 29 per cent for Newfoundland, 20 per cent for Prince Edward Island, 23 per cent for Nova Scotia and 20 per cent for New Brunswick.

A High Percentage of Failures are More than One Year Over-Age in Grade.

Almost half of the pupils who were over-age in Grade 7 were two or more years behind pupils of their own age group. A relatively higher percentage of the over-age boys than girls were in this group.

Association Between Inputs and Outputs

Expenditure on Education, Teacher Salaries and Teacher Qualifications have a Positive Association with School Retention Rates.

There is a high association between expenditures on education and pupil retention rates, and therefore a significant implied relationship between personal income and education output as measured by retention rates. There is a negative association between expenditures on education and retardation rates, as there is between retention rates and retardation rates.

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PROFILES OF EDUCATION
in the
ATLANTIC PROVINCES

PART THREE

POST-SECONDARY EDUCATION

PART THREE

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PART THREE

POST-SECONDARY EDUCATION

1. POST-SECONDARY INSTITUTIONS

Description and Distribution

Relative to their population, the Atlantic Provinces have a fairly large number of post-secondary institutions. Their geographic distribution by province is indicated in Figures 3-1 through 3-4.

Memorial is Newfoundland's only university. Associated with it are three affiliated institutions: Queen's College and St. John's College on campus and St. Bride's College at Littledale. Queen's College, operated by the Anglican Church has accommodation for 160 male and 105 female students. St. Bride's and St. John's Colleges are operated by the Roman Catholic Church. St. Bride's has accommodation for 200 female students, and St. John's College has accommodation for 50 male students. Men are educated for the Anglican priesthood at Queen's College and St. Bride's provides the first two years of teacher training for Roman Catholic girls. There are two institutions at St. John's where post-secondary technician training is given - the College of Trades and Technology and the College of Fisheries, Navigation, Marine Engineering and Electronics.

Prince Edward Island has two universities, Prince of Wales College and St. Dunstan's University, both at Charlottetown. It is now planned to combine these two institutions into one. A college of applied arts and technology is also planned.

In Nova Scotia several post-secondary institutions are located at Halifax. Dalhousie University is the largest and most comprehensive of the Nova Scotia universities. The University of King's College, affiliated as a liberal arts college with Dalhousie, also educates men for the Anglican priesthood in the Maritimes. St. Mary's of the archdiocese of Halifax is under the direction of the Jesuits and is now a coeducational university. Mount St. Vincent for women is also operated by the archdiocese of Halifax under the direction of the Sisters of Charity. Pine Hill is the divinity school for the United Shurch in the Atlantic Provinces. Holy Heart Seminary trains Roman Catholic priests. The Convent of the Sacred Heart is an all-grade school with a few students at the junior college level.

Figure 3-1

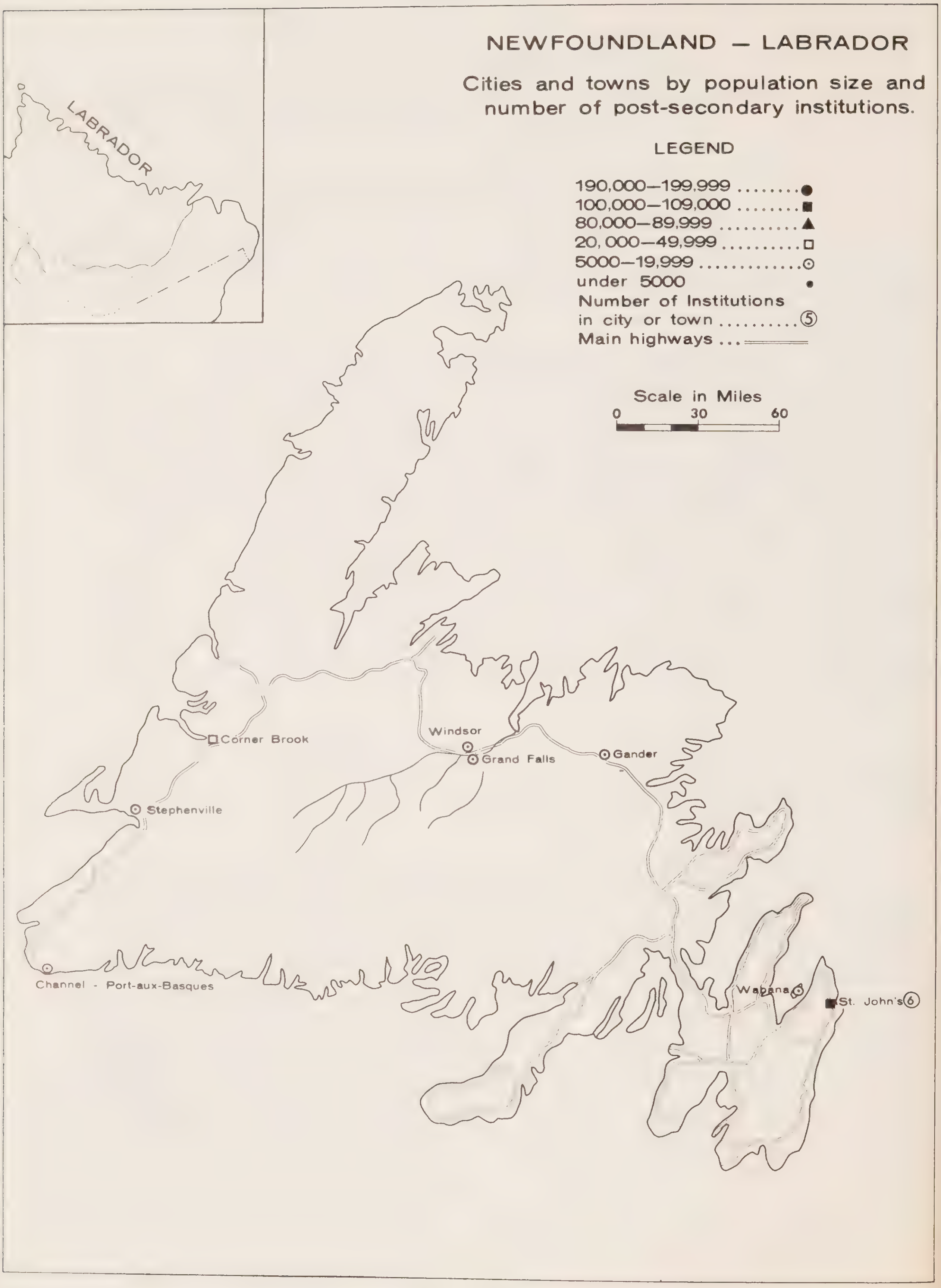

NEWFOUNDLAND — LABRADOR
Cities and towns by population size and number of post-secondary institutions.
LEGEND
190,000—199,999
100,000—109,000
80,000—89,999
20,000—49,999
5000—19,999
under 5000
Number of Institutions in city or town
Main highways
Scale in Miles
0
30
60
LABRADOR
Corner Brook
Windsor
Grand Falls
Gander
Stephenville
Channel - Port-aux-Basques
Wabana
St. John's
6

Figure 3-2

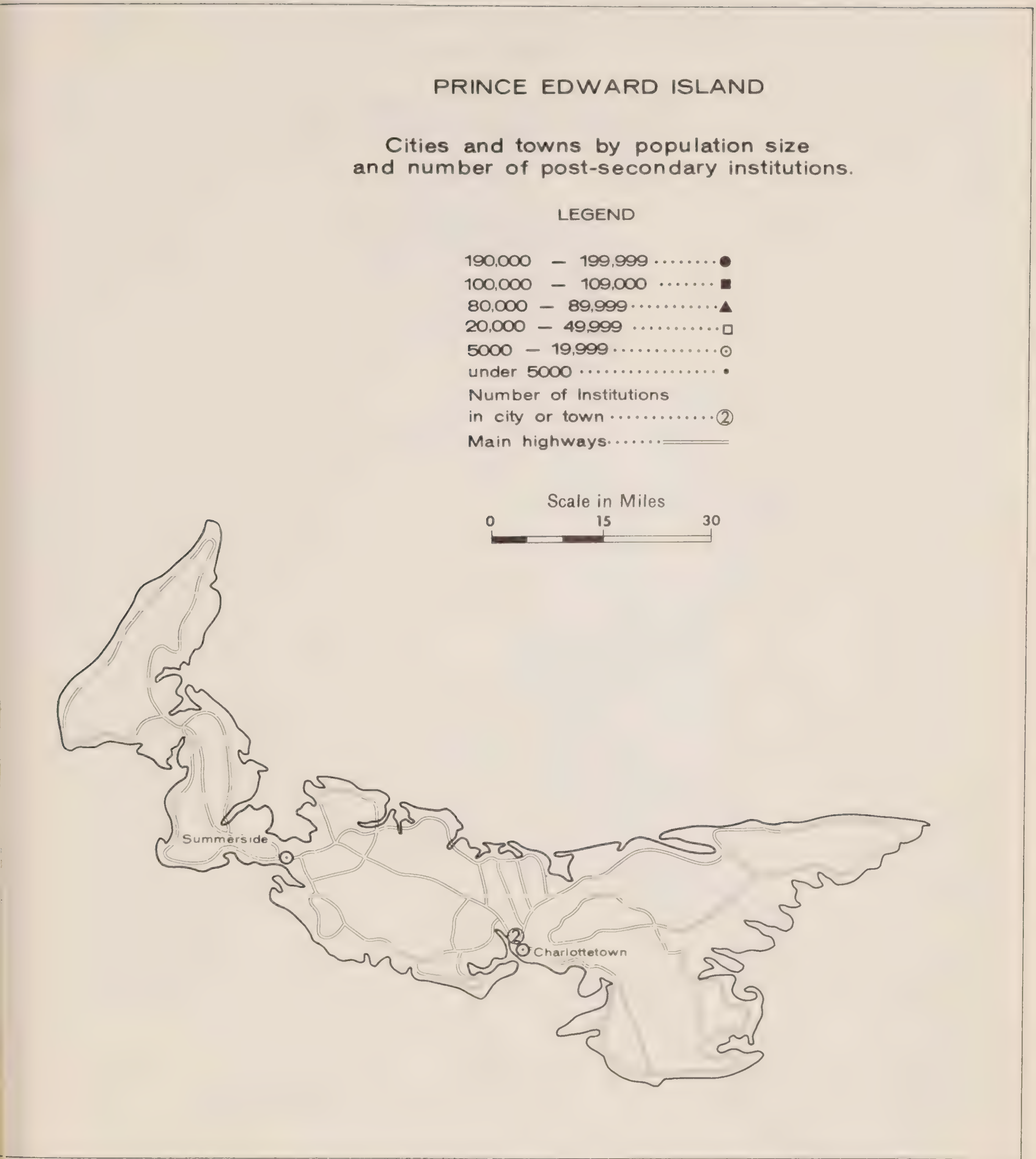

PRINCE EDWARD ISLAND
Cities and towns by population size and number of post-secondary institutions.
LEGEND
190,000 — 199,999
100,000 — 109,000
80,000 — 89,999
20,000 — 49,999
5000 — 19,999
under 5000
Number of Institutions in city or town
Main highways
Scale in Miles
0
15
30
Summerside
2
Charlottetown

Figure 3-3

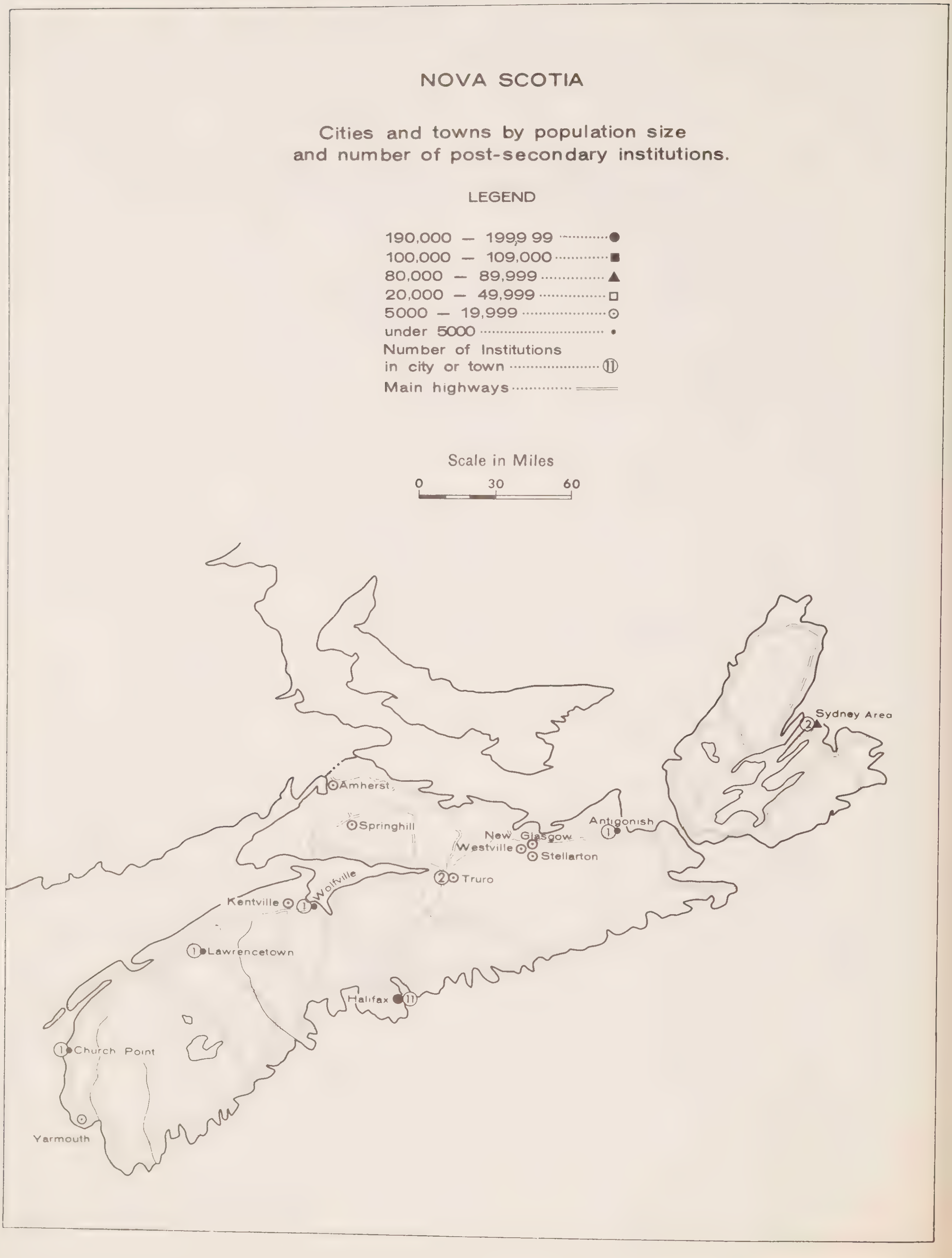
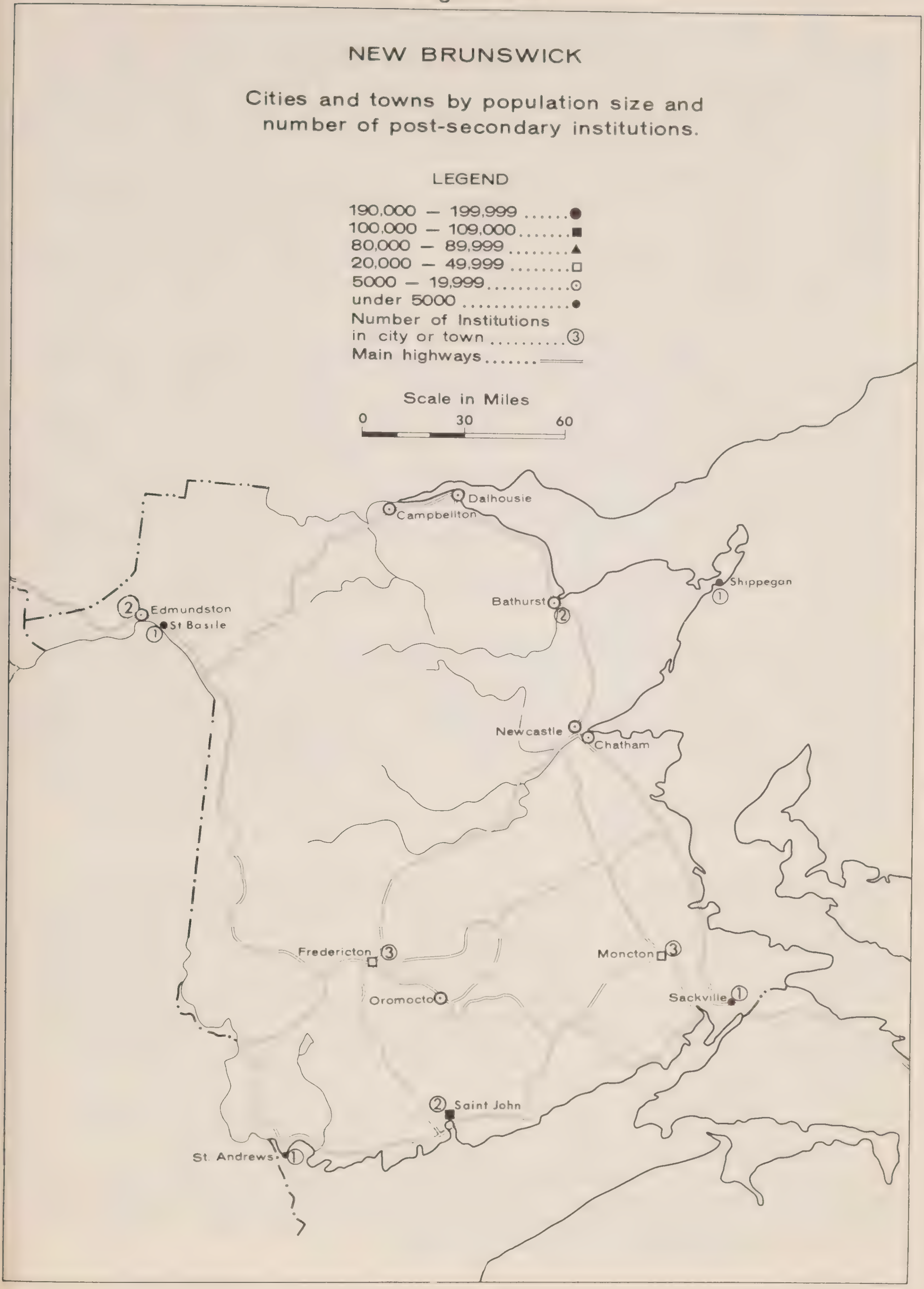

NOVA SCOTIA
Cities and towns by population size
and number of post-secondary institutions.
LEGEND
190,000 — 199,9 99
100,000 — 109,000
80,000 — 89,999
20,000 — 49,999
5000 — 19,999
under 5000
Number of Institutions
in city or town
11
Main highways
Scale in Miles
0
30
60
Amherst
Springhill
New Glasgow
Westville
Stellarton
Antigonish
1
Sydney Area
2
Truro
2
Kentville
Wolfville
1
Lawrencetown
1
Halifax
11
Church Point
1
Yarmouth

Figure 3-4


NEW BRUNSWICK
Cities and towns by population size and number of post-secondary institutions.
LEGEND
190,000 — 199,999
100,000 — 109,000
80,000 — 89,999
20,000 — 49,999
5000 — 19,999
under 5000
Number of Institutions in city or town
Main highways
Scale in Miles
0
30
60
Dalhousie
Campbellton
Shippegan
1
Bathurst
2
Edmundston
2
St Basile
1
Newcastle
Chatham
Fredericton
3
Moncton
3
Oromocto
Sackville
1
Saint John
2
St. Andrews
1

The Nova Scotia Government assumes financial responsibility for the Nova Scotia Technical College, an advanced school of engineering and architecture which receives students from several universities in the region. Several of the universities in Nova Scotia and New Brunswick grant degrees to specialists trained at the Maritime School of Social Work in Halifax.

At Wolfville, Nova Scotia, Acadia University has historical ties to the Baptist Church. At Antigonish, St. Francis Xavier University has historical ties to the Roman Catholic Church. It has established Xavier College at Sydney, and Mount Saint Bernard College for women at Antigonish is affiliated to St. Francis Xavier.

At Truro, the Nova Scotia Teachers' College is operated by the provincial Department of Education. Also at Truro, the Nova Scotia Agricultural College - operated by the Nova Scotia Department of Agriculture - draws students from the four Atlantic Provinces. It is a junior college, and it has arrangements with Macdonald College of McGill University and with the University of Guelph for continuation to a bachelor's degree in agriculture. Its students may also continue at the Nova Scotia Technical College for a bachelor's degree in engineering (with specialization in Agricultural Engineering). The Agricultural College also offers a broad program of post-secondary studies leading to technicians' diplomas and diplomas of technology.

At Church Point, Digby county, the Collège Ste. Anne, operated by the Eudist Fathers, serves the French population of western Nova Scotia. There are two technical institutes, the Nova Scotia Institute of Technology at Halifax and the Eastern Nova Scotia Institute of Technology at Sydney. Technician training is also provided at the Land Survey Institute in Lawrencetown, Annapolis county. The Nova Scotia College of Art, which gives a four-year diploma course in fine arts among other subjects and is currently planning degree courses, is located in Halifax.

Since 1962 university development in New Brunswick, in terms of professional, specialized and post-graduate work, has been increasingly concentrated at two locations: the University of New Brunswick in Fredericton for English-speaking students, and at the Université de Moncton for French-speaking students. For 1967-68, 72 per cent of total full-time enrolments in the province's universities and colleges (including affiliates and the teachers' college) were on the Fredericton and Moncton campuses.

Mount Allison, at Sackville, has historical ties to the United Church. Though it is located in New Brunswick, the majority of its students are residents of Nova Scotia. For a number of years it has followed a firm policy of developing as an undergraduate liberal arts college with a limited enrolment. Indeed, the enrolment at Mount Allison has remained virtually stationary at about 1,250 since 1961.

St. Thomas University has been moved from Chatham to the University of New Brunswick campus in Fredericton, where it provides, through its agreement with the University, courses in the liberal arts and in education, for both men and women. In addition, the University of New Brunswick has established a branch in Saint John which currently is limited to offering the first two years of certain undergraduate degree programs. Together these institutions are intended to meet the needs of the province's English-speaking population.

Since 1967, the Université de Moncton has been owned and administered by a lay board of governors of 21 members. The Université has three main affiliated colleges. Collège St. Joseph on the Moncton campus is operated by the Holy Cross Fathers; the Collège de Bathurst and the Collège St. Louis in Edmundston are both operated by the Eudist Fathers. The latter two themselves have small affiliated institutions for women students, operated by nuns. Affiliated to the Collège de Bathurst is the Collège Jésus-Marie at Shippegan, and affiliated to the Collège St. Louis is the Collège Maillet at St. Basile. By agreement, the activities of all the affiliated colleges have been confined to basic undergraduate education in arts and to certain teacher-training courses. The pattern of their future development is currently the subject of careful study.

New Brunswick has two teachers' colleges operated by the Department of Education. One is on the campus of the University of New Brunswick in Fredericton. The other opened in the autumn of 1968 on the campus of the Université de Moncton. Post-secondary technician training is provided at the New Brunswick Institute of Technology in Moncton and in the Saint John Technical and Trade Institute. Teachers of vocational education from all four Atlantic Provinces are trained at the New Brunswick Institute of Technology.

Co-operation Among Institutions

Concerning the early history of co-operation among institutions in the region, Mitchener (1961) wrote: "The now defunct University of Halifax was chartered, as was Manitoba initially, as an examining institution on the pattern of the University of London. It granted seven earned degrees from 1878 to 1880 to students studying at other institutions, but ceased operation without giving any course work itself". The University of Halifax was an attempt to partially unite existing institutions (King's, Dalhousie, Acadia, St. Mary's, St. Francis Xavier, and Mount Allison) but seems to have failed because its predecessors were too firmly established as independent entities.

The second serious attempt to achieve co-ordination among Nova Scotia colleges was proposed in a report by the Carnegie Foundation for the Advancement of Teaching (1922). This report suggested a form of confederation centred in a new

university, with the existing universities becoming affiliated colleges. Its authors apparently had not heard of the Halifax attempt. Following the Carnegie report, the Foundation earmarked $3 million for the development of a centralized educational scheme at Halifax. King's College, which had burned in 1920, agreed to terms of association with Dalhousie in 1923. An account of this is contained in Vroom (1941).

To serve as a buffer between governments and post-secondary institutions, some Canadian provinces have established commissions. These commissions normally have provincially appointed or approved members representing government, education, and community interests. Their terms of reference are, in general, to advise the government on development of provincial university, or post-secondary, resources; to advise on and sometimes to distribute financial assistance required; and to plan, together with the institutions, the implementation of programs to meet the expanding education needs of the province.

Newfoundland, with a single university, has not yet found need for a separately constituted advisory board. However, the recent report of the Newfoundland Royal Commission on Education and Youth (under the chairmanship of Dr. Philip Warren) suggested a system of regional colleges throughout the province, a development which could point the way to such a need.

Prince Edward Island has two universities, but if proposed legislation is adopted, will soon have one. A bill to establish a university grants commission was introduced early in 1968 but was withdrawn in favour of one to establish a commission on post-secondary education. The government has indicated its intention to combine the two universities, and to establish a college of applied arts and technology.

Nova Scotia established an advisory University Grants Committee in 1963, charged with inquiring into the financial support of Nova Scotia universities and some other post-secondary institutions, as well as of institutions outside the province which serve substantial numbers of Nova Scotia students. It was also asked to study curriculum offered, standards required, and facilities for pursuing the courses offered; to study ways of avoiding duplication of courses and facilities; to study possible areas of co-operation among institutions; and to advise on distribution of provincial funds. The committee issues annual reports embodying recommendations to the government and the institutions. The 1967 report indicates that its financial recommendations to the province have been acted on more readily than some of its recommendations to institutions. Recently, at the request of the Nova Scotia University Grants Committee, there was a meeting among officials of several post-secondary Halifax institutions - Dalhousie, King's, the Maritime School of Social Work, Mount St. Vincent, the Nova Scotia College of Art, the Nova Scotia Technical College and St. Mary's University. Matters pertaining to co-operation were discussed, and a co-

ordinating committee was set up under Dr. Arthur Murphy, Chairman of the Grants Committee. Subcommittees were formed to work out the details of affiliations and co-operative efforts among these institutions.

In New Brunswick, following publication of a report in 1967 by a committee on financing higher education chaired by Dr. John J. Deutsch, a commission on post-secondary education was formed. The commission includes a chairman (J.F. O'Sullivan) and eight other members from the education, business, professional and labour fields. The name was subsequently changed to the New Brunswick Higher Education Commission. Its objects and purposes are to advise the government on the needs and appropriate patterns of future development (including finance and student aid) of all forms of post-secondary education, and to undertake development planning with the institutions. It is also responsible for allocation of government operating and capital grants.

There is an association among universities and colleges in the Atlantic Provinces known as the Association of Atlantic Universities. Its purposes, as described in its constitution, are: (a) to assist the co-ordination of higher education in the Atlantic Provinces; (b) to ensure high academic standards in a period of rising costs of academic personnel, laboratories, libraries, etc.; and (c) to avoid unnecessary duplication of faculties and courses of study. The executive director is Dr. H.J. Somers.

2. UNIVERSITY LIBRARY RESOURCES

The adequacy of a university library depends in part upon the holdings of other nearby libraries, as well as upon its own stock of books. Universities located in large cities and provincial capitals often have available to students the sizable collections of public libraries, school libraries, and libraries of provincial legislatures, federal and provincial departments and, perhaps, professional associations. While Table 3-1 must be interpreted cautiously, it does suggest the superior position of Halifax universities and the decidedly disadvantageous positions of Collège Ste. Anne, Université de Moncton, the Nova Scotia Agricultural College, the Nova Scotia Teachers' College and similarly located institutions.

TABLE 3-1

Volumes in Libraries of Universities and Colleges of the Atlantic Provinces and of Other Selected Universities

Institution	Location	Date of Count	Volumes	1967-68 Full-Time Enrolments
			000	no.
Memorial	St. John's	8/67	163	4,446
Prince of Wales	Charlottetown	2/68	22	517
St. Dunstan's	"	3/68	37	852
Acadia	Wolfville	2/68	158	1,684
Collège Ste. Anne	Church Point	2/68	17	164
Dalhousie	Halifax	6/67	317	3,569
N.S. Technical College	"	12/67	37	411
Maritime School of Social Work	"	3/68	5	59
King's	"	2/68	55	201
Pine Hill (estimated)	"	3/68	40	47
St. Mary's	"	3/68	62	1,217
Mount St. Vincent	"	2/68	71	625
Holy Heart Seminary	"		n.a.	55
Convent of the Sacred Heart	"	/66	11	48
N.S. Teachers' College	Truro	2/68	20	661
N.S. Agricultural College	"	2/68	4	192
St. Francis Xavier	Antigonish	2/68	110	2,060
Xavier College	Sydney	2/68	39	447
Mount Allison	Sackville	11/67	142	1,291
N.B. Teachers' College	Fredericton		n.a.	1,158
St. Thomas	"	(Shares UNB Library)		505
University of N.B.	"	2/68	197)	3,827
Saint John Campus	Saint John	2/68	21)	
Université de Moncton and affiliates	Moncton	6/67	123	2,047
				(1965-66)
McGill	Montreal	(1964-65)	1,044	11,676
Western	London	"	470	6,032
Alberta	Edmonton	"	423	10,366
British Columbia	Vancouver	"	757	15,890

n.a. - not available.

Source: Data on library holdings of most universities and colleges of the Atlantic Provinces were obtained from counts supplied by librarians. However, data for the Convent of the Sacred Heart were taken from Higher Education in Nova Scotia 1965 (Halifax, University Grants Committee, 1966); data for universities not in the Atlantic Provinces were taken from: D.B.S. Survey of Libraries Part II, Academic Libraries (Ottawa, Queen's Printer, 1967). Enrolments for universities outside the Atlantic Provinces were taken from: D.B.S. Survey of Higher Education Part I (1965-66); Enrolments for universities within the Atlantic Provinces supplied by University Registrars.

Despite recent developments with microfilm and microfiche, the task of improving library services would appear somewhat formidable, especially since, on a per-student basis, universities in the Atlantic Provinces have tended to spend considerably less than universities elsewhere in Canada (Table 3-2).

However, there are some hopeful signs for the future. A school of library science is being established at Dalhousie University. The University of New Brunswick and Dalhousie University libraries are now both linked by telex with the National Library in Ottawa.

TABLE 3-2

Library Operating Expenses per Full-Time University Student*

Province	1962-63	1963-64	1964-65	1965-66
	$	$	$	$
Newfoundland	69 (1)	71 (1)	65 (1)	64 (1)
Prince Edward Island	24 (2)	37 (2)	30 (2)	69 (1)
Nova Scotia	52 (9)	69 (9)	95 (9)	108 (9)
New Brunswick	62 (4)	64 (4)	64 (4)	80 (4)
Atlantic	52 (16)	64 (16)	76 (16)	90 (15)
Canada	80 (73)	88 (80)	99 (80)	127 (76)

* Including institutions with 100 or more full-time students. Figures in parentheses refer to the number of institutions reporting.

Source: D.B.S. Preliminary Statistics of Education 1963-64 to 1966-67.

3. CHARACTERISTICS OF TEACHING STAFF

Full-time student enrolment in the post-secondary educational institutions of the region almost tripled over the last decade, rising from somewhat over 10,000 in the school year 1957-58 to almost 30,000 in 1967-68 (Table 3-3). While 92 per cent of this increase occurred in universities and colleges, technical institutes grew at the most rapid rate, with enrolment multiplying nine times. Student increases in teachers' colleges and universities were 151 per cent and 186 per cent respectively. Part-time enrolments rose at a much faster rate.

By comparison, full-time enrolments in universities and colleges (including teachers' colleges) in Canada as a whole increased from 96,000 in 1957-58 to 284,000 in 1967-68 - a growth of 196 per cent.

Within the region, Newfoundland registered the greatest relative increase in post-secondary students, largely the result of a fivefold increase in the number of university students. Prince Edward Island registered a total post-secondary gain of 250 per cent, followed by New Brunswick at 193 per cent and Nova Scotia at 137 per cent.

In 1967-68 technical students in post-secondary courses in New Brunswick were almost seven times their number 10 years earlier, while the number of students in the teachers' college and universities nearly tripled. In Nova Scotia the 10-year rates of growth were: teachers' college, 107 per cent; universities, 133 per cent, and technical institutes, 413 per cent. It should be remembered that enrolments in technical institutes at the beginning of the decade were extremely small. Universities play a larger role in post-secondary education in Nova Scotia than in New Brunswick.

The number of full-time teaching personnel rose 249 per cent over this period, a somewhat greater relative change than the increase in student numbers. (See Table 3-3.) Again the largest percentage increase was in Newfoundland (494 per cent), followed by Prince Edward Island (336 per cent), Nova Scotia (247 per cent) and New Brunswick (183 per cent).

The teaching staff of technical institutes increased to 13 times its 1957-58 level, reflecting the small base in that year. Newfoundland first reported teachers for its two technical colleges in 1963-64. Since that time growth has been about equal in Newfoundland and New Brunswick. Nova Scotia also registered significant growth, and in this province there has been a substantial replacement of part-time by full-time teachers.

TABLE 3-3

Historical Trends in Post-Secondary Education in the Atlantic Provinces

	1957-58	1967-68	% Increase
	no.	no.	%
Full-time student enrolment*	10,117	29,903	196
Part-time student enrolment‡	644	3,760	484
Full-time teaching staff	655	2,283	249
Part-time teaching staff	224	538	140
Administrative staff	308	1,319	328
Full-time student-teacher ratios	15:1	13:1	n.a.
Technical Institutes#	12:1	8:1	n.a.
Teachers' colleges	18:1	19:1	n.a.
Universities	15:1	13:1	n.a.

* Excludes technical institutes in Newfoundland.

‡ Part-time enrolments reported only by universities.

\# Nova Scotia and New Brunswick.

Source: Atlantic Development Board, Stock and Flow of Personnel in Post-Secondary Educational Institutions in the Atlantic Provinces, 1968. (An unpublished study prepared for the Board by the Atlantic Provinces Economic Council.)

Full-time university staff rose 227 per cent in the region with provincial increases in the same rank order, and of similar magnitudes, as for all post-secondary teachers. Teachers' colleges registered an increase of 141 per cent - 167 per cent in Nova Scotia and 125 per cent in New Brunswick. Except for Nova Scotia technical institutes, part-time teachers are important only in universities, where an increase of 170 per cent was recorded over the 10-year period.

Rather surprisingly, the region as a whole shows little change in student-teacher ratios over this decade for two of the institutional types and for post-secondary education as a whole.

Individual provinces display varying trends and levels, as do the institutions themselves, but these are offsetting at the regional level.

For universities, the student-teacher ratio rose in Newfoundland, fell in Prince Edward Island and Nova Scotia, and held steady in New Brunswick. The teachers' college ratio fell in Nova Scotia but rose in New Brunswick, and in both provinces is above the university average. For technical institutes the Nova Scotia figures show a rapid drop since 1963-64, while in New Brunswick the ratio held constant.

The problem of interpreting the data for technical schools in Nova Scotia arises as the result of the move from dependence on part-time teaching staff (32 of a total of 36 in 1957-58) to a point in 1967-68 where full-time personnel accounted for 63 of the total of 79 teachers. Because of such interpretation problems it would be desirable to attempt some conversion of part-time students and faculty to full-time equivalents before attempting to project manpower requirements.

The reported increase in administrative staff for the 10-year period was about 1,000 persons, or 328 per cent, resulting in a decline in the aggregate student-administrator ratio from 33:1 in 1957-58 to 23:1 in 1967-68. The value of these statistics is doubtful. The range from institution to institution is so wide as to make any average of little use.

Age Distribution

The distribution of teachers by age is relevant to the rate of teacher turnover and, therefore, to the relation between future teacher demand and supply.

In the school year 1967-68 about 35 per cent of all Atlantic Region post-secondary teachers were between the ages of 30 and 39, with the under-30, 40-49 and 50-64 groups each containing between 15 and 20 per cent of the total (Table 3-4). Teachers at technical institutes were generally younger, and at teachers' colleges older, than university teachers.

For technical institutes three age brackets each contained about one-third of the teachers - under-30, 30-39 and 40 and over (when those not reporting age are excluded). In New Brunswick the age distribution shifted toward younger members, with almost half under 30.

In teachers' colleges the under-40, 40-49, and 50-64 groupings each contained one-third of the faculty with the Nova Scotia staff being younger than that in New Brunswick.

The 30-39 group contained 36 per cent of university teachers, followed by 20 per cent in the 40-49 range. There were 17 per cent under 30 and 15 per cent 50 and over. The age

TABLE 3-4

Percentage Distribution of Post-Secondary Teaching Staff by Age, 1967-68*

Type of Institution	Age Groups					Not Known
	Under 30	30-39	40-49	50-64	65+	
	%	%	%	%	%	%
Technical Institutes	27.9	29.6	12.9	13.3	-	16.3
Teachers Colleges	8.2	19.4	33.7	34.7	1.0	3.1
Universities	17.4	35.8	19.8	13.2	1.7	12.2
Total	18.1	34.5	19.6	14.1	1.5	12.2

* Excludes a certain number of teachers concerning whose characteristics information was unavailable.

Source: Atlantic Development Board. Stock and Flow.... op. cit.

distributions of Prince Edward Island and New Brunswick were generally younger than the region, while Nova Scotia's faculty was somewhat older.

Place of Birth

This section gives an indication of the extent to which the Atlantic Region provides its own post-secondary teachers. The following section will indicate the degree to which the region is able to provide these teachers with their final level of education.

The region itself was the main source of post-secondary teachers, with 49 per cent reporting one of the four provinces as their province of birth. This excludes Memorial University, for which no information was received, and 270 other teachers (mostly part-time staff of Dalhousie University) for whom no place of birth was reported. Teachers' colleges are highest in proportion of native-born (83 per cent), followed by technical institutes (74 per cent) and universities (43 per cent). (See Table 3-5.)

Teachers' colleges had small numbers of staff members from other provinces within the region, Canadian provinces outside the region, the United Kingdom and Continental Europe. The technical institutes also had small numbers from other provinces of the region, provinces outside the region, the United

TABLE 3-5

Post-Secondary Teaching Staff by Place of Birth, Atlantic Provinces, 1967-68*

Place of Birth	Technical Institutes	Teachers' Colleges	Universities‡
	no.	no.	no.
Newfoundland	57	1	8
Prince Edward Island	1	-	65
Nova Scotia	60	30	313
New Brunswick	59	50	265
Other Provinces	22	7	291
United States	2	-	137
United Kingdom	21	5	137
France	1	-	48
Germany	1	-	39
Other Europe	7	2	98
Africa	-	-	18
Australia and New Zealand	1	-	9
Central and South America	1	-	16
India	5	-	48
Other Asia	2	-	35
Not Available	-	3	267
Total	240	98	1,794

* Excludes a certain number of teachers for whom information was unavailable.

‡ Excludes Newfoundland.

Source: Atlantic Development Board. Stock and Flow.... op. cit.

Kingdom, Continental Europe and India. Birth places were more diversified for university staff, including members from all continents. There were significant numbers from the United States, United Kingdom, France, Germany, and India. In total, the ratio of teachers born in the region to those born in the rest of Canada was more than 2:1. European-born teachers outnumbered those from the other six provinces of Canada. The United States and United Kingdom were of equal importance as sources of teachers for the region's universities. In all three Maritime Provinces at least 61 per cent of the teachers were Canadian born, 66 per cent in Prince Edward Island being the highest.

Of the 1,527 teachers in Maritime universities for whom place-of-birth information was obtained, 651 (43 per cent) were born in the Atlantic Region. The rest of Canada provided 19 per cent, followed by the United States and United Kingdom

at 9 per cent each. French- and German-born each accounted for 3 per cent of the total, the rest of Europe 6 per cent and Asia 5 per cent. There were 18 faculty members from Africa, 9 from Australia and New Zealand, and 16 from Central and South America.

About 47 per cent of Prince Edward Island university teachers were island-born, a total of 9 per cent in Nova Scotia and New Brunswick, 10 per cent in provinces outside the region.

Nova Scotians made up 34 per cent of that province's university teaching faculty, with 8 per cent coming from other parts of the region, 19 per cent from other provinces, and a total of 22 per cent from the United Kingdom and Continental Europe. The New Brunswick proportions were almost identical.

Place where Highest Degree was Earned

Of 143 teachers in technical institutes with degrees listed by place where earned, 118 had degrees from Canadian institutions and 25 from other countries (10 of which were from American degree-granting institutions). Of the Canadian degrees 104 were from within the region and 14 from the other six provinces. (*See* Table 3-6.)

In Newfoundland there were 16 persons with degrees from that province, 15 from the Maritimes and 2 from the rest of Canada out of a total of 41 degree-holders. In Nova Scotia 27 final degrees were obtained within the province, 4 in other Atlantic Provinces, 12 in provinces outside the Atlantic Region and 13 in foreign countries, making a total of 56. New Brunswick's 46 degrees were more concentrated - 36 from New Brunswick, 6 from Nova Scotia and 4 from foreign countries.

The teachers' colleges listed 80 persons with degrees, 14 non-Canadian of which 12 were United States. The Nova Scotia staff had 16 obtaining degrees in that province; 28 of the New Brunswick staff of 40 were granted their degrees in the province.

Again, university staff members appear to be less "local", though there is still significant concentration; one-quarter of the degree-holding staff in 1967-68 obtained their highest degree within the region. Another quarter had obtained other Canadian degrees, and there were almost as many from the United States and from Europe.

In Newfoundland almost 40 per cent of the university staff had obtained their highest degrees in Canada, two-thirds of these outside the region. In the other three provinces about half of the teaching personnel earned Canadian degrees, with about equal division between regional and non-Atlantic institutions. The United States was of the same importance as the rest of Canada in each of the four provinces. At the regional level Europe provided about the same number of teachers as the United

TABLE 3-6

Post-Secondary Teaching Staff by Place where Highest Degree Earned, Atlantic Provinces, 1967-68*

Place where Highest Degree Earned	Total	Technical Institutes	Teachers' Colleges	Universities
	no.	no.	no.	no.
Newfoundland	31	16	-	15
Prince Edward Island	3	1	-	2
Nova Scotia	389	44	17	328
New Brunswick	240	43	31	166
Other Provinces	532	14	14	504
United States	503	10	12	481
United Kingdom	294	5	1	288
France	85	1	1	83
Germany	28	-	-	28
Other Europe	78	3	-	75
Africa	10	-	-	10
Australia and New Zealand	7	-	-	7
Central and South America	8	1	-	7
India	21	1	-	20
Other Asia	11	2	-	9
Not Available	24	2	4	18
No Degree	153	97	18	38
Total	2,417	240	98	2,079

* Excludes a certain number of teachers for whom information was unavailable.

Source: Atlantic Development Board, Stock and Flow.... op. cit.

States and as the six non-Atlantic provinces of Canada. In Europe, the United Kingdom was the most important single country, followed by France. It should be noted that, in New Brunswick, France provided more than three-quarters as many teachers as the United Kingdom, 54 for France to 71 for the United Kingdom.

Location of Previous Post-Secondary Teaching Appointment

This section and the two following sections deal with the experience and tenure of post-secondary teachers, factors likely to affect the rate of teacher turnover.

Information for this portion of the survey was not available from Memorial University and Nova Scotia Teachers' College.

Of the teachers at technical institutes, 83 per cent were still at the institution to which they were first appointed (Table 3-7). The provincial percentages were 77 in Nova Scotia, 83 in New Brunswick and 89 in Newfoundland. The 40 with previous appointments included 22 in other post-secondary institutions of the Atlantic Provinces, 7 in other provinces, 4 in the United States, and 4 in Europe.

TABLE 3-7

Distribution of Teaching Staff by Location of Previous Post-Secondary Teaching Appointment, Atlantic Provinces, 1967-68*

Location	Technical Institutes	Teachers' Colleges‡	Universities#
	no.	no.	no.
First Appointment	200	41	940
Atlantic Provinces	22	3	113
Other Provinces	7	5	175
United States	4	5	141
Europe	4	-	100
Other	2	-	16
Not Available	1	-	309
Total	240	54	1,794

* Excludes a certain number of teachers for whom information was unavailable.

‡ New Brunswick only.

Maritime Provinces.

Source: Atlantic Development Board. Stock and Flow.... op. cit.

Of the 54 teachers at the New Brunswick Teachers' College, 41 (76 per cent) received their first post-secondary appointment at this college. (The relationship in Nova Scotia is believed to be similar.) Of the balance, three previous appointments were in the Maritimes, five in provinces outside the Atlantic Region, and five in the United States.

Somewhat more than 50 per cent of the university teaching staff were reported in 1967-68 as being at the institu-

tion to which they were first appointed. The range was narrow - from 50 per cent in New Brunswick to 54 per cent in Nova Scotia. The Nova Scotia distribution of those with previous appointments is not too useful in that locational details were not available for 300 of the 488 persons involved. However, a large portion of these are part-time people, so the full-time distribution is not as greatly disturbed. Because of the weight of Nova Scotia, the Maritime total is affected as well.

In New Brunswick universities, some 28 per cent of the staff had previous post-secondary teaching appointments in Canada, about evenly divided between the Atlantic Region and the rest of Canada. The proportion in Prince Edward Island was almost identical for the other provinces of Canada, but was only half as large for the Atlantic Provinces. Previous appointments in the United States and Europe each accounted for 10 per cent of the total New Brunswick faculty members. In Prince Edward Island the proportions were 12 per cent and 4 per cent respectively.

Number of Years of Post-Secondary Teaching Experience

Information on length of post-secondary teaching experience was collected only in the province of Nova Scotia. Almost 45 per cent of all post-secondary teachers reported less than 10 years of post-secondary teaching experience (Table 3-8). Information was not available on half of the total. Because of this it is difficult to relate tenure and experience.

TABLE 3-8

Teaching Personnel in Nova Scotia by Post-Secondary Teaching Experience, 1967-68

Number of Years	Technical Institutes	Teachers' Colleges	Universities	Total
	no.	no.	no.	no.
1-3	5	14	260	279
4-6	5	10	116	131
7-9	3	10	84	97
10-19	5	2	145	152
20-29	5	5	51	61
30+	3	1	24	28
Not Available	44	2	379	425
Total	70	44	1,059	1,173

Source: Atlantic Development Board. Stock and Flow.... op. cit.

For technical institutes post-secondary teaching experience in the region would be very short because many of the institutions concerned are five years old or less. Very few technical institute teachers reported previous appointments. Over three-quarters of the Nova Scotia Teachers' College staff had less than 10 years of such teaching experience. For full-time university staff some 43 per cent had under 10 years experience, 14 per cent had 10-19 years and 7 per cent 20 or more years. There was no information for 37 per cent.

Table 3-9 gives some indication of length of experience (probably mostly teaching experience) of the full-time teaching staff of Canadian universities and colleges. Comparisons are made between the Atlantic Region, Québec, Ontario and the Western Provinces. Among these regions, the Atlantic Provinces had by far the highest percentage of teaching staff with less than five years experience following the award of a first degree, and a somewhat higher percentage than any other region in the 5-9 year group. This region also had the highest percentage (by a small margin) in the 30-and-over group. In each of the intervening groups, however, the Atlantic Region had the lowest percentage.

TABLE 3-9

Full-Time Teaching Staff of Canadian Universities and Colleges: Years to 1965 Since Award of First Degree

Region	Number of Years						No University Degree	No Information
	0-4	5-9	10-14	15-19	20-29	30+		
	%	%	%	%	%	%	%	%
Atlantic Region	12.8	22.8	18.3	17.3	15.2	11.3	1.2	1.1
Québec	7.4	19.5	20.3	18.7	17.0	9.9	1.4	5.8
Ontario	7.2	21.6	20.3	19.0	15.9	11.2	1.5	3.3
Western Region	7.2	22.1	21.5	20.1	16.1	10.3	1.6	1.1

Source: D.B.S. Salaries and Qualifications of Teachers in Universities and Colleges, 1965-66.

Number of Years Teaching at Present Institution

For the region as a whole, the percentages of those reporting who were in their present institutions for 1-3 years came to 57 per cent for technical institutes, 46 per cent for universities and only 31 per cent for teachers' colleges. Those reporting tenure of 10 years or more comprised 12 per cent for technical institutes, 16 per cent for universities and 26 per cent for teachers' colleges. Tenure of 1-3 years at universities ranged from 50 per cent in Nova Scotia to 66 per cent in Prince Edward Island; for technical institutes, from 49 per cent in Nova Scotia to 67 per cent in New Brunswick. In view of the re-

cent rapid expansion of most post-secondary institutions such high proportions of persons with only short periods of tenure are not surprising. (See Table 3-10.)

TABLE 3-10

Percentage Distribution of Teaching Staff by Number of Years at Present Institution, Atlantic Provinces, 1967-68*

Type of Institution	Number of Years						
	1-3	4-6	7-9	10-19	20-29	30+	Not Known
	%	%	%	%	%	%	%
Technical Institutes	56.7	25.4	6.2	7.5	3.3	0.8	-
Teachers' Colleges	30.6	26.5	16.3	14.3	11.2	1.0	-
Universities	46.3	14.5	8.4	11.1	3.8	0.9	15.0
Total	46.7	16.0	8.5	10.9	4.1	0.9	12.9

* Excludes a certain number of teachers for whom information was unavailable.

Source: Atlantic Development Board. Stock and Flow.... op. cit.

Highest Earned Degree

In the school year 1967-68, 7 per cent of post-secondary teachers in the Atlantic Provinces had no university degree (Table 3-11). Of the total of 159 in this category, 98 were in technical institutes, 44 in universities and 17 in teachers' colleges. Twenty-one per cent of all teachers had a bachelor's degree, 37 per cent a master's, and 35 per cent a doctorate. While Nova Scotia institutions employed 48 per cent of all post-secondary teachers in the region, they had 64 per cent of those holding a Ph.D. or equivalent. New Brunswick, with one-third of all teachers, had only 21 per cent of teachers with Ph.D. degrees.

Over 40 per cent of the technical teachers did not possess a university degree, while 43 per cent had a bachelor's degree and 16 per cent a master's or doctorate. In Newfoundland, and also in New Brunswick, about half of the teachers had no degree, while most of the remaining half had a B.A. or equivalent. Technical teachers in Nova Scotia had higher academic qualifications: 43 per cent were at the bachelor's level, 30 per cent at the master's, and 6 per cent had doctorates, leaving only 21 per cent with no degree.

TABLE 3-11

Percentage Distribution of Teaching Staff by Highest Degree Earned, Atlantic Provinces, 1967-68*

Type of Institution	No Degree	B.A.	M. A.	Ph.D.
	%	%	%	%
Technical Institutes	40.8	43.3	13.8	2.1
Teachers' Colleges	17.3	37.8	41.8	3.1
Universities	2.1	17.8	39.5	40.5
Total	6.6	21.2	37.1	35.2

* Excludes a certain number of teachers for whom information was unavailable.

Source: Atlantic Development Board. Stock and Flow.... op. cit.

On the staff of the teachers' colleges 17 per cent had no degree, 38 per cent had a bachelor's, 42 per cent a master's and 3 per cent a doctorate. Nova Scotia teachers' college staff members had generally higher educational backgrounds than their counterparts in New Brunswick.

Forty per cent of university personnel had a degree at the doctorate level, another 40 per cent had an M.A. or equivalent, leaving 18 per cent at the bachelor's level and 2 per cent with no degree. Compared to this regional distribution, Prince Edward Island and New Brunswick had smaller proportions of Ph.D.'s, more M.A.'s, and about the same relative number of persons with bachelor's degrees. Nova Scotia was proportionally higher at the Ph.D. level and lower for bachelor's. Newfoundland had a slightly higher number of bachelor's and somewhat fewer doctorates.

Table 3-12 shows a percentage distribution of full-time teaching staff of Canada's universities and colleges by highest degree earned. Data are for the school year 1965-66 and for each region as well as for the country as a whole. The Atlantic Region, with 33 per cent of its staff holding doctorates, was lowest of all regions; the average for Canada was 44 per cent and Ontario had 52 per cent. At the other end of the scale, 22 per cent of the Atlantic Region's teaching staff had either a first baccalaureate or no university degree compared to only about 13 per cent for Canada and each of the other regions.

The Atlantic Region had the lowest percentages of doctorates for professors, associate professors, assistant pro-

TABLE 3-12

Percentage Distribution by Highest Earned Degree of Full-Time Teaching Staff of Universities and Colleges, 1965-66

(including both lay and religious teachers)

Region or Degree	Deans	Professors	Associate Professors	Assistant Professors	Professors Ungraded*	Lecturers and Instructors	Total
	%	%	%	%	%	%	%
Atlantic Provinces							
Doctorate	50.0	57.1	47.9	32.7	13.6	4.9	33.4
Master's	39.3	25.5	36.5	51.2	59.1	46.0	42.6
First professional degree beyond first baccalaureate	3.6	10.2	4.7	5.9	13.6	7.7	6.9
First baccalaureate	7.1	6.1	10.1	9.0	4.6	38.2	15.5
No university degree	-	1.0	0.4	1.0	-	2.1	1.0
No information	-	-	0.4	0.2	9.1	1.1	0.6
Québec							
Doctorate	37.7	58.1	50.2	36.7	12.5	9.8	34.4
Master's	45.9	23.8	29.8	39.5	40.0	50.5	37.8
First professional degree beyond first baccalaureate	13.2	13.0	11.6	11.5	22.7	14.2	13.5
First baccalaureate	1.6	4.4	6.8	10.6	18.3	18.9	11.3
No university degree	-	-	0.5	1.1	0.7	3.6	1.3
No information	1.6	0.7	1.1	0.6	5.8	3.0	1.7
Ontario							
Doctorate	56.6	71.5	66.9	52.7	61.5	7.6	52.0
Master's	30.3	16.2	21.5	34.9	19.2	56.2	31.3
First professional degree beyond first baccalaureate	9.1	4.2	2.6	2.7	-	4.6	3.5
First baccalaureate	4.0	7.9	8.5	8.7	7.7	25.2	11.5
No university degree	-	0.1	0.4	0.7	11.6	5.7	1.5
No information	-	0.1	0.1	0.2	-	0.7	0.2
Western Provinces							
Doctorate	65.0	71.2	59.4	47.6	50.0	5.9	47.2
Master's	21.6	15.8	26.3	37.3	35.8	51.0	33.2
First professional degree beyond first baccalaureate	6.7	5.9	4.6	4.1	7.1	4.5	4.7
First baccalaureate	6.7	5.9	7.8	9.4	-	30.1	12.1
No university degree	-	0.7	0.8	0.7	-	5.6	1.6
No information	-	0.5	1.1	0.9	7.1	2.9	1.2
Canada							
Doctorate	53.2	67.3	59.4	45.2	17.6	7.4	44.4
Master's	33.1	18.6	26.1	38.5	39.5	52.1	34.6
First professional degree beyond first baccalaureate	8.9	7.0	5.2	5.6	19.9	7.5	6.6
First baccalaureate	4.4	6.5	8.1	9.4	16.0	26.4	12.0
No university degree	-	0.3	0.6	0.8	1.4	4.7	1.4
No information	0.4	0.3	0.6	0.5	5.6	1.9	1.0

* In some small colleges the ranks of associate professor and assistant professor are not used; all above the rank of lecturer or instructor are classed as professors.

Source: D.B.S. Salaries and Qualifications of Teachers in Universities and Colleges, 1965-66.

fessors and for lecturers and instructors, and it had the second lowest percentage in the country (Québec being the lowest) for deans and ungraded professors. For the Atlantic Region and Canada as a whole, the respective percentages were: deans 50 and 53 per cent, professors 57 and 67 per cent, associate professors 48 and 59 per cent, assistant professors 33 and 55 per cent, ungraded professors 14 and 18 per cent, and lecturers and instructors 5 and 7 per cent.

The respective percentages for the Atlantic Region and Canada for those with only a first baccalaureate or no university degree were: deans 7 and 4 per cent, professors 7 and 7 per cent, associate professors 11 and 9 per cent, assistant professors 10 and 10 per cent, ungraded professors 5 and 17 per cent, and lecturers and instructors 40 and 31 per cent.

The shortage of qualified staff seems due in part to the scarcity of students at the doctoral level in Atlantic Provinces universities. Instead of producing their own instructor capital, they must rely to a large extent on outside universities, although the situation is beginning to improve in some disciplines. Only seven earned doctorates were awarded by Atlantic Provinces universities in 1955-56, and in 1963-64 just six. However, by 1967-68, 29 doctorates were awarded, and in that year 258 students were enrolled in full-time doctoral programs. These included 159 at Dalhousie University, 90 at the University of New Brunswick, 8 at the Nova Scotia Technical College and 1 at Memorial University. Virtually all graduate degrees have been in the physical sciences and engineering, but 1967-68 enrolments included 25 doctoral students in English, 12 in history, 6 in mathematics and 33 in psychology. In other crucial fields, notably education, economics, sociology and commerce, there are no doctoral students. Also, many of the doctoral students originate in and return to areas outside the Atlantic Provinces.

Rank

Table 3-13 presents the distribution of the university teaching staff in the region by rank for the school year 1967-68. Provincial detail indicates that, proportionally, Newfoundland had fewer professors and associate professors, but more assistant professors and lecturers than the region as a whole. Prince Edward Island reported more associate and assistant professors, but fewer lecturers, while New Brunswick, compared to the regional average, had fewer associate professors and more lecturers. Nova Scotia was relatively high in professors and associate professors, but low in lecturers.

According to Table 3-14, in 1966-67 the Atlantic Region had percentages of professors and associate professors below the national average and percentages of assistant professors, lecturers and instructors above it.

TABLE 3-13

Percentage Distribution of University Teaching Staff by Rank, 1967-68*

Rank	Full-Time	Part-Time	Total
	%	%	%
Deans	2.3	nil	1.9
Professors	16.0	3.9	14.0
Associate Professors	21.2	16.6	20.5
Assistant Professors	35.3	16.0	32.3
Lecturers	21.0	40.4	24.1
Others	4.2	23.2	7.2
Total	100.0	100.0	100.0

* Excludes a certain number of teachers for whom information was unavailable.

Source: Atlantic Development Board. Stock and Flow.... *op. cit.*

TABLE 3-14

Percentage Distribution, Full-Time Teaching Staff, by Rank and Region, 1966-67

Rank	Atlantic Region	Central Canada	Western Region	Canada
	%	%	%	%
Deans	2.6	1.8	1.5	1.8
Professors	18.7	24.9	17.6	21.1
Associate Professors	21.5	25.6	28.6	26.4
Assistant Professors	36.2	30.7	38.0	34.4
Lecturers and Instructors	21.0	16.0	13.6	15.5
All Ranks	100.0	100.0*	100.0*	100.0*

* Includes 64 ungraded professors not included elsewhere (39 in Central Canada, and 25 in the West).

Source: D.B.S. Salaries and Qualifications of Teachers in Universities and Colleges, 1966-67.

Teachers' Plans for the School Year 1968-69

The survey summarized in Table 3-15, conducted in the summer of 1968, indicates an over-all teacher retention rate of 89 per cent - that is, all but 11 per cent of teachers on staff in 1967-68 planned to remain at their present institution for the 1968-69 school year. There was almost no variation among the three types of institutions. For technical institutes the regional retention rate was 90 per cent with a range from 84 per cent in New Brunswick to 96 per cent in Newfoundland.

TABLE 3-15

Departures Planned by Post-Secondary Teachers Prior to 1968-69 Academic Year, Atlantic Provinces*

Plans	Technical Institutes	Teachers' Colleges	Universities
	no.	no.	no.
Total Departures	23	11	233
Continue to Teach	3	2	68
In Prince Edward Island	-	-	7
In Nova Scotia	2	-	9
In New Brunswick	-	-	14
In other provinces	-	2	19
In other countries	1	-	19
Leave Teaching	20	9	132
To resume studies	8	1	57
For sabbatical leave	1	3	28
For post-secondary administration	1	-	16
For other occupation	2	-	14
To Retire - family	6	2	7
To Retire - other	2	3	10
Reason not Specified	-	-	33

* Excluding "no replies" and an additional number of teachers for whom information was unavailable.

Source: Atlantic Development Board. Stock and Flow.... op. cit.

For teachers' colleges the average rate was 89 per cent, with provincial rates of 82 per cent in Nova Scotia and 94 per cent in New Brunswick.

The regional university rate was also 89 per cent, with a range from 82 per cent in Prince Edward Island to 90 per cent in Nova Scotia. The lower Prince Edward Island rate may be related to the controversy generated by the government's move to amalgamate the two universities. One institution was responsible for 38 "No replies" in New Brunswick, and these persons have been eliminated from this analysis, as have four "No replies" in Nova Scotia.

Of 22 departures from technical institutes, only two persons were intending to teach in 1968-69. Those leaving the profession for this year were mainly planning to resume their studies or retire. Only three were taking up other occupations. The situation with respect to teachers' colleges was similar, except that sabbatical leave replaced resumption of studies.

In the case of university departures, 29 per cent planned to continue to teach; 57 per cent were leaving the profession, while details on the remaining 14 per cent were unavailable. Of those continuing to teach, 44 per cent were intending to remain in the region, with the balance moving in equal numbers to other provinces and other countries.

Almost two-thirds of those leaving university teaching were resuming their studies or taking sabbatical leave. It is thus likely that many intend to resume their teaching careers in the near future. Thirty people were going into new occupations, about half into post-secondary administration. Retirement claimed 17 persons, 7 per cent of all departures.

4. SALARIES OF TEACHING STAFF

Annually the Canadian Association of University Teachers publishes data supplied to the Dominion Bureau of Statistics by the various institutions concerning the salaries of full-time lay teaching staff at Canadian universities and colleges, including average salaries by academic ranks. Table 3-16 indicates that in 1966-67, 41 institutions reported, including 10 in the Atlantic Provinces. For average salary of all staff, none of the reporting Atlantic universities was in the top quartile. The rank for Dalhousie was 14th, for Nova Scotia Technical College 17th. All others were below the median rank, half in the bottom quartile. For full professors, no Atlantic university was above the median; for associates, only St. Francis Xavier. Thus, teaching staff in the Atlantic Provinces are less well qualified, on the average, than elsewhere, and salaries for each academic rank are lower. The D.B.S. Daily Bulletin for February 3, 1967, in analysing these data, stated: "While percentage increases for the Atlantic Provinces kept pace with other regions, they did not appreciably close the gaps that have existed for many years. These gaps were particularly large among the senior academic ranks."1/

Rosenbluth's study of variations in academic salaries in Canada in 1965-66 suggests the variables underlying these low rankings of Atlantic universities. Low salaries in Canada are associated with small enrolments, church-controlled and privately-controlled institutions, lower academic ranks, younger ages, lower qualifications, and the liberal arts. The universities and staffs in the Atlantic Provinces more often than elsewhere fit these classifications. But even with all these variables held constant, Rosenbluth found that males in the Atlantic universities received \$1,400 less than their counterparts in Ontario having similar qualification, rank, sex, age and field of specialization, in institutions of similar size and type.2/ They received \$1,500 less than their counterparts in Québec and \$1,100 less than their counterparts in the West. For females the differentials were almost as great. (Rosenbluth, 1967)

1/ Cited in University Salaries in 1966-67, C.A.U.T. Bulletin 15 (February, 1967): 31.

2/ To close the \$1,400 gap between salaries of 1,500 professors in the Atlantic Provinces and their counterparts in Ontario in 1965-66 would have cost about \$21 million.

TABLE 3-16

Rank Order among Similar Canadian Institutions of Atlantic Universities and Colleges by Average Salary Paid Full-Time Lay Teaching Staff in 1966-67

Institution	Rank Order of Average Salaries Paid to: All Staff	Full Professors	Associates	Assistants	Rank Below Assistant
Memorial University	28	33	31	24	31
Prince of Wales Coll.	41	*	39	39	39
St. Dunstan's University	35	*	*	32	*
Dalhousie University	14	19	24	10	21
Nova Scotia Technical College	17	28	30	12	16
St. Mary's University	29	*	21	33	37
St. Francis Xavier University	31	20	14	35	36
Mount Allison	30	35	35	26	28
University of New Brunswick	22	30	33	34	23
Universite de Moncton	40	36	38	41	38
Number of Institutions Reporting	41	36	39	41	39

* Not ranked because no teachers in this category or numbers too small to preserve confidentiality.

Source: Salaries of Full-Time Lay Teaching Staff at Canadian Universities and Colleges, 1966-67. C.A.U.T. Bulletin 15 (Feb. 1967): 21-30.

He found also that the differential between Atlantic and other universities was greater when rank was excluded from the analysis than when rank was included. This reflects the higher proportion of low-ranking staff in Atlantic universities.

Table 3-17 indicates another disadvantageous comparison; the ratio of full-time students to full-time teaching staff is higher in the Atlantic Provinces than elsewhere in Canada, although the gap is declining.

The university student in the Atlantic Provinces, compared to his counterpart elsewhere in Canada, has had less adequate libraries and less qualified instructors with heavier teaching loads. Moreover, even with the same qualifications instructors have received less pay.

TABLE 3-17

Average Number of Full-Time Students per Full-Time Faculty Member, 1961-62 to 1967-68

Year	Atlantic Provinces	Canada
	no.	no.
1961-62	15.4	12.2
1962-63	15.1	12.1
1963-64	13.9	12.2
1964-65	14.0	12.5
1965-66	14.8	14.1
1966-67 (estimate)	13.4	13.7
1967-68 (estimate)	13.4	12.9

Source: Estimated ratios for 1967-68 were calculated from data contained in D.B.S. Advance Statistics of Education 1967-68, and Atlantic Development Board, Stock and Flow of Personnel in Post-Secondary Educational Institutions in the Atlantic Provinces, 1968; the ratios for 1966-67 and 1965-66 were contained in D.B.S. Salaries and Qualifications of Teachers in Universities and Colleges, 1966-67; for earlier years, ratios were calculated from data contained in D.B.S. Survey of Higher Education Part II, 1964-65.

5. FINANCE

Table 3-18 shows that, in 1966-67, operating expenditures per student in the Atlantic Region were about $500 below the Canadian average and about $1,100 below the level for Ontario. A substantial proportion of these differences is accounted for by lower costs of instruction per student in the Atlantic Region. However, universities' expenditures as a percentage of personal income were higher in the Atlantic Provinces than in any other region of Canada. The figure for the Atlantic Region was 1.33 per cent, compared to a Canadian average of 1.23 per cent. Salaries and wages as a percentage of total operating expenditures were lower in the Atlantic Region than in any other region of the country: 62.7 per cent, compared to an average for Canada of 66.5 per cent.

TABLE 3-18

Indicators of Operating Expenditures, Including Assisted Research, 1966-67

Indicators	Atlantic Provinces	Québec	Ontario	Western Provinces	Canada
Total Operating Expenditures ($ 000)	43,436	154,338	214,813	166,628	579,215
Full-Time Enrolment (no.)	21,700	75,070	68,589	67,313	232,672
Expenditures per Student ($):					
Instruction	1,084	1,119	1,646	1,396	1,351
Library	142	109	212	182	164
Administration	151	197	226	147	187
Plant Maintenance	219	229	309	236	253
Total Operation Expenditures	2,002	2,056	3,132	2,475	2,489
Increase over Previous Year (%) in:					
Full-Time Enrolment	8.9	11.5	16.3	12.8	13.0
Total Expenditures	33.2	24.8	41.1	34.6	34.0
Expenditures per Student	22.4	11.9	21.3	19.3	18.5
Total Salaries and Wages ($ 000)	27,249	107,198	143,168	107,429	385,044
Salaries and Wages as % of Total Operating Expenditures	62.7	69.5	66.6	64.5	66.5
Universities' Current Expenditures as % of:					
Personal Income	1.33	1.27	1.15	1.29	1.23
Total Education Expenditures	..	..	..	..	14.02
National Income	..	..	..	..	1.25
Gross National Product	..	..	..	..	0.93

Source: D.B.S. Daily Bulletin, October 29, 1968, p. 6.

The increase over the previous year in total enrolment in the Atlantic Region was 8.9 per cent, the lowest of any, the Canadian figure being 13.0 per cent. Total expenditures in the Atlantic Region increased by 33.2 per cent over the preceding year, slightly below the Canadian advance of 34.0 per cent. Expenditures per student increased over the previous year by 22.4 per cent in the Atlantic Region, the most rapid advance of any region; the Canadian average was 18.5 per cent.

With the exception of the Province of Québec, the Atlantic Region in 1966-67 received the highest percentage of operating expenditures of any region of the country in the form of students' fees: 27.3 per cent, compared to 22.3 per cent for Canada. The federal government provided 34.2 per cent of operating expenditures in the Atlantic Region, the highest percentage in the country; the figure for Canada as a whole was 23.0 per cent. Provincial governments provided 26.5 per cent in the Atlantic Region, the lowest percentage in the country; the Canadian figure was 42.8 per cent. (See Table 3-19.)

In 1966-67 the federal government contributed a much larger percentage to capital expenditure in the Atlantic Region than in any other region of the country (Table 3-20). The figures for the Atlantic Region and Canada were 17.4 and 3.5 per cent respectively. The position was reversed with respect to provincial grants, the Atlantic Region having the lowest percentage among the regions. The figures for the Atlantic Region and Canada were 15.1 and 61.1 per cent respectively. Loans made up 44.2 per cent of capital expenditures in the Atlantic Region, a much higher percentage than any other region, the Canadian percentage being only 18.5.

Stated as simply as possible, the Federal-Provincial Fiscal Arrangements Act, 1967 is a vehicle through which federal transfers of fiscal resources are made to assist the provinces in meeting the rising costs of post-secondary education. The Act makes provision for the provinces to receive, for 1967-68, the higher of (a) $15 per capita of population or (b) 50 per cent of eligible operating expenditures of post-secondary education institutions. Three of the 10 provinces (Newfoundland, Prince Edward Island and New Brunswick) were in 1967-68 on the $15-per-capita rate. Escalation of this per-capita base in future years is based on the national rate of increase of eligible costs. When, in any of the three provinces, 50 per cent of eligible costs equals or exceeds the entitlement on a per-capita basis, that province will move to the 50-per-cent base. Movement can only be to the 50-per-cent base.

For the purposes of the Act, post-secondary education is defined as every course of studies that requires for admission the attainment of a level not lower than that of junior matriculation in each province.[1/] Thus the expenditures of the

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1/ However, federal contributions to training leading to Registered Nurse in hospital schools of nursing are made through health grants.

TABLE 3-19

Sources of Total Operating Income, Including Funds for Assisted Research, 1966-67

Source	Atlantic Provinces	Québec	Ontario	Western Provinces	Canada
	$ 000				
Student fees	11,828	43,297	42,700	32,128	129,953
Federal government	14,799	18,077	57,454	43,353	133,683
Provincial government	11,464	61,464	97,049	79,102	249,079
Municipal government	3	-	444	1,312	1,759
Corporations	218	1,970	1,327	1,441	4,956
Foundations	421	1,479	3,545	3,696	9,141
Religous organizations	1,326	11,982	2,489	1,497	17,294
Alumni	43	604	347	22	1,016
Other gifts	478	727	1,441	1,694	4,340
Endowments	2,105	3,911	3,001	489	9,506
Other income (including ancillary enterprises net)	607	7,550	7,083	5,617	20,857
Total income	43,292	151,061	216,880	170,351	581,586
Ancillary enterprises (gross)	8,290	18,834	23,240	20,602	70,966
	per cent				
Student fees	27.3	28.6	19.7	18.9	22.3
Federal government	34.2	12.0	26.5	25.4	23.0
Provincial government	26.5	40.7	44.7	46.4	42.8
Municipal government	-	-	0.2	0.8	0.3
Corporations	0.5	1.3	0.6	0.8	0.9
Foundations	1.0	1.0	1.6	2.2	1.6
Religious organizations	3.0	7.9	1.1	0.9	3.0
Alumni	0.1	0.4	0.2	-	0.2
Other income	1.1	0.5	0.7	1.0	0.7
Endowments	4.9	2.6	1.4	0.3	1.6
Other income (including ancillary enterprises)	1.4	5.0	3.3	3.3	3.6
Total income	100.0	100.0	100.0	100.0	100.0
Ancillary enterprises (gross)	19.1	12.5	10.7	12.1	12.2

Source: D.B.S. Daily Bulletin, October 29, 1968.

TABLE 3-20

Capital Income and Expenditures, 1966-67

	Atlantic Provinces	Québec	Ontario	Western Provinces	Canada
	$ 000				
1. Balance at beginning of year	8,416	3,490	28,024	12,324	52,254
Income					
2. Federal government grant	5,608	457	796	4,293	11,154
3. Provincial government grant	4,851	26,946	103,675	57,576	193,048
4. Municipal government grant	-	-	448	2,038	2,486
5. Corporations	1,600	1,186	4,390	492	7,668
6. Foundations	832	414	226	947	2,419
7. Religious organizations	854	728	5,501	1,388	8,471
8. Alumni	937	147	3,262	10	4,356
9. Other gifts	1,847	2,171	2,690	4,246	10,954
10. Plant funds	298	281	987	185	1,751
11. Transfer in, less transfer out	1,007	4,554	6,013	2,312	13,886
12. Profit or loss on cap. assets	133	7	601	382	1,109
13. Net income (2 to 12)	17,967	36,877	128,589	73,869	257,302
14. Loans	14,238	5,107	22,435	16,693	58,473
15. Total (13+14)	32,205	41,984	151,024	90,562	315,775
16. Grand total (1+15)	40,621	45,474	179,048	102,886	368,029
Expenditures					
17. Land	899	2,162	10,802	850	14,713
18. Buildings and contents	35,273	34,572	133,747	90,478	294,070
19. Total expenditure (17+18)	36,172	36,734	144,549	91,328	308,783
20. Balance at end of year	4,449	8,740	34,499	11,558	59,246
21. Grand total (19+20)	40,621	45,474	179,048	102,886	368,029
	per cent				
Income					
2. Federal government grants	17.4	1.1	0.5	4.7	3.5
3. Provincial government grants	15.1	64.2	68.6	63.6	61.1
4. Municipal government grants	-	-	0.3	2.3	0.8
5. Corporations	5.0	2.8	2.9	0.6	2.4
6. Foundations	2.6	1.0	0.1	1.0	0.8
7. Religious organizations	2.7	1.7	3.6	1.5	2.7
8. Alumni	2.9	0.3	2.2	-	1.4
9. Other gifts	5.7	5.2	1.8	4.7	3.5
10. Plant funds	0.9	0.7	0.7	0.2	0.5
11. Transfer in, less transfer out	3.1	10.8	4.0	2.6	4.4
12. Profit or loss on cap. assets	0.4	-	0.4	0.4	0.4
13. Net income (2 to 12)	55.8	87.8	85.1	81.6	81.5
14. Loans	44.2	12.2	14.9	18.4	18.5
15. Total (13+14)	100.0	100.0	100.0	100.0	100.0
Expenditures					
17. Land	2.5	5.9	7.5	0.9	4.8
18. Buildings and contents	97.5	94.1	92.5	99.1	95.2
19. Total expenditures	100.0	100.0	100.0	100.0	100.0

Source: D.B.S. Daily Bulletin, October 29, 1968.

senior matriculation high school year are eligible for inclusion in calculating total resource transfers. To be eligible under the Act, post-secondary courses were to be of not less than 24 weeks duration and must be certified as such by provincial authorities.

The Act indicated what expenditures were not considered as operating expenditures of post-secondary institutions. In general, these include amounts expended for student financial aid; for the capital cost of land, buildings, physical plant, facilities or equipment (except as otherwise provided by regulation); for interest on capital debts; for depreciation or rent on buildings, physical plant, facilities, or equipment; and for certain ancillary enterprises undertaken or operated by an educational institution. The Department of the Secretary of State administers the adjustment payments.

The costs of university education include not only operating and capital expenditures of universities but also the personal expenses of students. A future increase in the proportion of young people enrolled in post-secondary education implies the extension of enrolments into the lower-income segments of the population. Their participation will have to be encouraged. For them the prospects of a $1,500-2,500 debt under the Canada Students Loan Plan, especially for a first-year student, may be beyond contemplation. Also, with students comprising a higher proportion of the population, summer and part-time jobs become harder to get. With more graduate students and more students married and with families, costs will be even higher.

6. SUMMARY

Full-Time Student Enrolment in Post-Secondary Institutions in the Atlantic Region almost Tripled over the Last Decade.

Enrolment increased from somewhat over 10,000 in the school year 1957-58 to just over 30,000 in 1967-68. Though 92 per cent of this increase occurred in universities and colleges, technical institutes grew at the most rapid rate, with enrolment multiplying nine times. Student increases in teachers' colleges and universities were 151 per cent and 186 per cent respectively. Part-time enrolment in universities rose to almost six times its 1957-58 level.

For Historical Reasons, there is a Relatively Large Number of Universities and Colleges in the Atlantic Region.

There are more than a score of universities and colleges, many of them over a century old. Over half have full-time enrolments of less than a thousand students. There are relatively few technical institutes, all of which have either been opened or greatly expanded within the past few years.

Operating Expenditures per University Student in the Atlantic Provinces are Substantially below the Canadian Average.

In 1966-67, operating expenditures per student in the Atlantic Region were about $500 below the Canadian average and around $1,100 below the level for Ontario. A substantial proportion of these differences is accounted for by lower costs of instruction per student in the Atlantic Region. Compared to his counterpart elsewhere, the Atlantic Provinces student has less adequate libraries and less qualified instructors with heavier teaching loads. Moreover, even with similar qualifications, instructors at all ranks have received less pay. University salaries and wages as a percentage of total operating expenditures in 1966-67 were lower in the Atlantic Provinces than in any other region - 62.7 per cent compared to an average for Canada of 66.5 per cent.

Despite the relatively low level of expenditure, however, university expenditures represent a higher proportion of personal income in the Atlantic Provinces than elsewhere - 1.33 per cent compared to a Canadian average of 1.23 per cent.

Only in Québec do Student Fees Contribute a Higher Proportion of University Operating Costs.

Student fees provided 27.3 per cent of operating expenditures in the Atlantic Region in 1966-67; 22.3 per cent in Canada as a whole. The federal government provided 34.2 per cent of opera-

ting expenditures in the Atlantic Region, the highest percentage in the country; the figure for Canada as a whole was only 23.0 per cent. Atlantic provincial governments provided the lowest share - 26.5 per cent; the Canadian average for provincial contributions was 42.8 per cent.

The Federal-Provincial Fiscal Arrangements Act, 1967 is a vehicle through which federal transfers of fiscal resources are made to assist the provinces in meeting the rising costs of post-secondary education. For 1967-68, the Act provided the higher of (a) $15 per capita of population or (b) 50 per cent of eligible post-secondary operating expenditures. Three of the 10 provinces (Newfoundland, Prince Edward Island and New Brunswick) were on the $15-per-capita rate in 1967-68. When in any of these three provinces $15 per capita equals or exceeds the 50 per cent figure, it will move to the latter base. Movement can only be to the 50-per-cent base.

For Capital Expenditure in 1966-67, the Federal Government Contributed a much Larger Share in the Atlantic Region than Elsewhere.

The federal shares for the Atlantic Region and Canada as a whole were 17.4 and 3.5 per cent respectively. The position was reversed with respect to provincial capital grants, Atlantic Provinces contributing 15.1 per cent, compared to a provincial share of 61.1 per cent for Canada as a whole. Loans made up 44.2 per cent of capital expenditures in the Atlantic Region, a much higher percentage than in any other region, the Canadian figure being only 18.5 per cent.

A Future Increase in the Proportion of Young People Enrolled in Post-Secondary Education Implies the Extension of Enrolments into the Lower-Income Segments of the Population.

Their participation will have to be encouraged. For them the prospect of a $1,500-2,500 debt under the Canada Students Loan Plan, especially for a first-year student, may be beyond contemplation. Also, with higher proportions of the population students of one kind or another, summer and part-time jobs become harder to get. With more graduate students and more students married and with families, costs will be even higher.

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PROFILES OF EDUCATION
in the
ATLANTIC PROVINCES

PART FOUR

FUTURE ENROLMENTS AND
TEACHER REQUIREMENTS

PART FOUR

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PART FOUR

FUTURE ENROLMENTS AND TEACHER REQUIREMENTS

From the earlier Parts of this report it is clear that future enrolments at the elementary, secondary and post-secondary levels will be determined by the interaction of a large number of dynamic variables: population and birth rates; migration; retention and retardation in school; school organization; teaching techniques; social and demographic factors - to name a few. Not all are capable of quantitative analysis.

In the sections which follow, the starting point is population projections, with some notes on the difficulties of determining what the appropriate school-age groups should be. Populations of the selected age groups are then projected (based on assumptions noted) to 1986.

Elementary and secondary school enrolments are considered together, and forecasts are made to 1986 for each of the Atlantic Provinces. Again, critical assumptions are made. Based on expected enrolments and estimated student-teacher ratios the numbers of teachers required in 1971 and 1976 are projected. Because of the uncertainties surrounding future changes in teaching techniques, no attempt is made to estimate ratios beyond that point. However, the number of teachers needed for later years, assuming student-teacher ratios remain at 1976 levels, is noted. Finally, based on these projections, the annual numbers of new teachers required in each of the Atlantic Provinces are estimated to 1986-87.

Similar procedures are followed in forecasting post-secondary enrolments and teacher requirements, although teacher estimates are limited to full-time places in universities and colleges.

1. POPULATION FORECASTS BY AGE GROUPS

Determination of Appropriate Age Groups

Future elementary and secondary school enrolments are based on the future population 5-19 years of age inclusive.

Enrolment of students 5-14 years of age for the school year 1966-67 as a percentage of the mid-1966 census population of the corresponding age group was 94.3 per cent in Newfoundland, 91.3 per cent in Prince Edward Island, 98.6 per cent in Nova Scotia and 89.9 per cent in New Brunswick.1/ The relatively high percentage in Nova Scotia reflects the existence in that province of a preprimary grade which is attended by more than 90 per cent of five-year-olds. Newfoundland's relatively high percentage among the remaining three provinces reflects some development of kindergarten classes in that province. School attendance is compulsory to age 15 in Newfoundland and Prince Edward Island and to age 16 in Nova Scotia and New Brunswick. However, in the latter two provinces attendance is compulsory only to age 14 in a few rural districts. One factor encouraging continuation beyond the compulsory age is the federal youth allowance for students age 16-18. It is paid only on behalf of those attending school.

In the school year 1966-67 school enrolments of persons 15-19 years of age inclusive as a percentage of the population of the corresponding age group at the mid-1966 census was 47.3 per cent in Newfoundland, 54.3 per cent in Prince Edward Island, 55.0 per cent in Nova Scotia and 52.3 per cent in New Brunswick.1/ In Newfoundland and Nova Scotia, junior matriculation comes at the completion of Grade 11. The modal age for this grade is 16 years. While this is the final school grade in Newfoundland, in Nova Scotia there is a Grade 12 with senior matriculation available at its completion. The modal age for Grade 12 is 17 years. Some students acquire senior matriculation in school while others acquire it in university. In Prince Edward Island and New Brunswick there is no senior matriculation grade, but junior matriculation requires the completion of Grade 12. In both provinces the modal age for this grade is 17 years. In Grades 11 and 12 significant proportions of enrolments are found to be of students one or two years beyond the modal age. Thus, the 15-year age range from 5 to 19 years is required to encompass elementary and secondary school enrolments.

1/ Calculated from Census of Canada and from data supplied by D.B.S. Education Division and Nova Scotia Department of Education, Research Section.

Students characteristically enter post-secondary institutions at age 18 or 19. A first general degree normally requires four years after junior matriculation or three years beyond senior matriculation, and an honours degree an additional year. Master's degrees and doctorates and professional degrees add more years. Teachers' colleges give two-year courses and technical institutes usually two- or three-year courses.

Thus, while the seven-year age range from 18 to 24 years will not cover all full-time post-secondary students, and while many will have completed their education before reaching the upper end of this age range, this bracket appears to be the most reliable base to use when forecasting full-time post-secondary enrolments. Part-time and summertime enrolments cover a very much broader age span, but we do not attempt to forecast these in the present study. The 18-24 range was used by Illing and Zsigmond (1967) and also by Sheffield (1966) for their post-secondary enrolment projections for Canada.

Assumptions Underlying the Population Forecasts

Age-specific fertility rates have been declining for several years, and it is assumed that they will continue to decline to reach a floor in 1971, where they will hold constant for the remainder of the forecast period. It is assumed that, by 1971, they will have declined to 80 per cent of their 1966 level.

Age-specific fertility rates were not available for Newfoundland, but the distribution of ages of females and their ages at marriage could be obtained. This distribution most closely resembles New Brunswick's, although the gross fertility rate is considerably higher in Newfoundland. Therefore, the New Brunswick age-specific fertility rates were raised in the same proportion at all age levels and applied to the Newfoundland distribution of females to produce the estimate of Newfoundland births. This means that each New Brunswick age-specific fertility rate was multiplied by 1.361, and errors may have been introduced if the differences in the ages of conception diverge from the differences in the ages of marriage as between the two provinces.

It was assumed that net migration for each age group will be the average of the rates for 1956-61 and 1961-66.

Survival rates for each age-sex group were taken from the 1960-62 Atlantic Provinces Life Tables except for an upward adjustment for those over 60 years of age in Prince Edward Island and those over 64 years in New Brunswick. These adjustments were made in line with more recent data.

Population Forecasts

Based on the preceding assumptions, Table 4-1 gives forecasts for the school and the post-secondary population of each of the four Atlantic Provinces.

TABLE 4-1

Population 5-19 and 18-24, 1967 Estimates with Forecasts to 1986, Atlantic Provinces

Province & Age Group	1967 Estimates	1971	1976	1981	1986
	----------------	000	----------------		
Newfoundland					
5-19 years	187.9	192.6	191.9	186.7	187.5
18-24 years	59.8	67.6	73.5	76.5	75.7
Prince Edward Island					
5-19 years	36.6	36.0	33.1	28.9	26.9
18-24 years	11.7	12.5	12.7	13.3	11.8
Nova Scotia					
5-19 years	245.6	244.5	227.0	203.1	188.2
18-24 years	84.9	92.3	96.3	99.3	89.6
New Brunswick					
5-19 years	217.0	213.9	198.8	178.9	167.0
18-24 years	71.6	77.6	80.2	81.7	73.8

In all three Maritime Provinces the school-age population has just about reached its peak (1969), and there is to be a sharp decline after 1971. In Newfoundland, however, the peak is not to occur until 1971 and the decline will not set in until after 1976. In all four Atlantic Provinces the peak in the post-secondary population will be reached in 1981. There will then ensue a sharp decline in each of the three Maritime Provinces but only a slight one in Newfoundland. In each of the Maritime Provinces the 1986 figure is lower than that for 1971.

2. SCHOOL ENROLMENT FORECASTS BY PROVINCE

Assumptions Underlying the School Enrolment Forecasts

Any attempt to forecast separately elementary and secondary school enrolments would be frustrated by the intention of educational authorities to move from a grade promotion to a subject promotion system. Age promotion also appears to be gaining importance. Such an attempt is also discouraged by the intention of certain jurisdictions to change the groupings of grades at each school level.

Enrolment in each of the four Atlantic Provinces as a percentage of the population 15-19 years of age is assumed to rise steadily to 70 per cent by 1986-87. This percentage was reached in British Columbia in 1966-67 and almost reached in that year in Ontario, Saskatchewan and Alberta.1/ Senior matriculation in school is not available in Newfoundland, Prince Edward Island or New Brunswick, and in Nova Scotia also a sizable proportion of senior matriculants is at university. Ontario and British Columbia provide both junior and senior matriculation in school, but in none of the Prairie Provinces is junior matriculation available. Thus, the proportion of Atlantic Region senior matriculants is much above the national average. Assuming that this situation will continue to exist throughout the forecast period, the above-mentioned 20-year gap does not seem unreasonable.

When the level of attendance of the 15-19 age group reaches 70 per cent, the proportions of constituent ages represented should be as follows: 15 years, 97 per cent; 16 years, 93 per cent; 17 years, 90 per cent; 18 years, 60 per cent; and 19 years, 10 per cent. If the population numbers by single years are equal, these percentages will average 70 per cent for the group as a whole. If the population of the group is declining rapidly, as it is expected to do between 1981 and 1986, the proportion may be as low as 68 per cent. A rapidly increasing population could raise the proportion as high as 72 per cent.

With the exception of some loss in New Brunswick at age 14, the differences that occur in the proportion of the 5-14 group enrolled are due to differences in enrolment at age five. The percentages of the 5-14 group enrolled in 1967-68 were: Nova Scotia 98.5 per cent, Newfoundland 94 per cent and Prince Edward Island and New Brunswick each 90 per cent. As more than 90 per cent of five-year olds in Nova Scotia are now enrolled, the percentage of enrolments among the 5-14 group is not expected

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1/ Calculated from Census of Canada, and data supplied by D.B.S. Education Division.

to increase. In Newfoundland the percentage of this group enrolled is expected to reach the figure for Nova Scotia as kindergarten enrolments increase. The percentages for the 5-14 group in Prince Edward Island and New Brunswick are not expected to rise more than one or two percentage points until the costs of secondary education stabilize and funds become available for kindergarten enrolment.

In Newfoundland, it is assumed that, by 1986-87, vocational school education for teen-agers will have become integrated with secondary education. In Nova Scotia, enrolments include those in the special vocational schools.

School Enrolment Forecasts

Table 4-2 gives school enrolment forecasts based on the preceding assumptions. The anticipated trends are shown graphically in Figure 4-1.

TABLE 4-2

School Enrolment 1967-68, with Forecasts to 1986-87, Atlantic Provinces

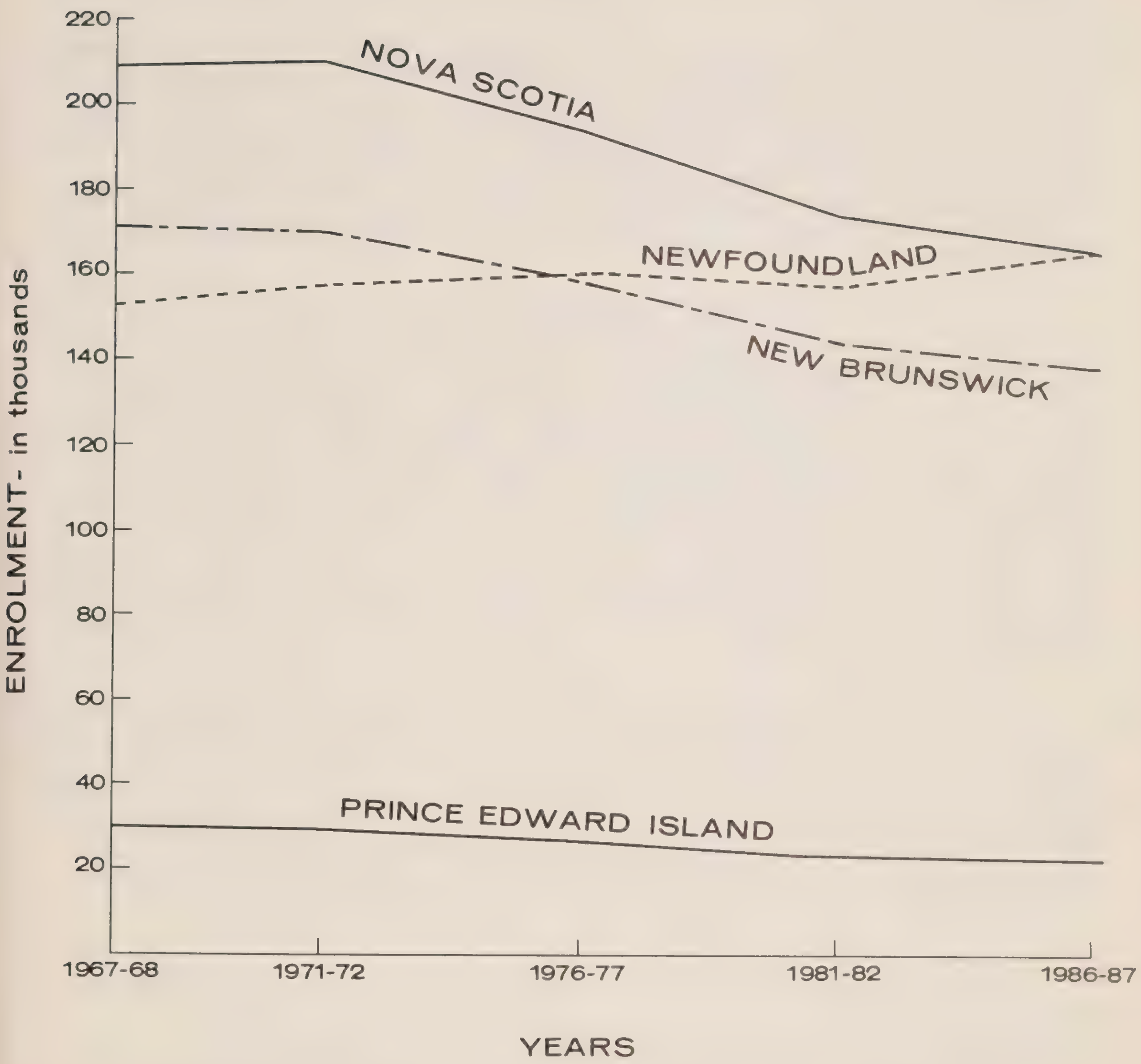
Year	Newfoundland	Prince Edward Island	Nova Scotia	New Brunswick
	----------	000	----------	
1967-68 Actual*	152.2	29.4	208.6	171.3
1971-72	157.4	29.0	209.5	170.1
1976-77	160.1	26.6	194.1	159.2
1981-82	159.6	23.4	175.0	144.7
1986-87	166.3	22.5	167.3	139.7

* D.B.S. Education Division.

It is apparent that in all three Maritime Provinces total school enrolment is close to its peak at the present time and that from 1971 there will be a relatively steep decline lasting to 1981-82, after which the rate of decrease will moderate. In Newfoundland, the peak is not to be reached until 1976-77 and, after a slight decline during the ensuing five years, there should be a resumption of growth leading to a peak for the entire period in 1986-87.

FIGURE 4-1

FORECAST OF SCHOOL ENROLMENTS
ATLANTIC PROVINCES, 1967-68 TO 1986-87



Source: Table 4-2

3. FUTURE REQUIREMENTS FOR SCHOOL TEACHERS

Student-Teacher Ratios

In Canada, interprovincial differences in student-teacher ratios are fairly broad, but these variations show no correlation with pupils per school in each province. While Newfoundland's ratios have been substantially above the national average, those for the Maritime Provinces have been quite close to it.

The development of educational television, programmed teaching, team teaching, subject promotion, etc., render projections of more than a few years' duration hazardous in the extreme. Furthermore, a least-squares straight-line projection of past negative trends in the student-teacher ratios would ultimately produce unrealistic results. It was therefore decided not to attempt to project future numbers of teachers beyond 1976-77.

Over the 11-year period from 1957-58 to 1967-68 there was a decline in the student-teacher ratio in Newfoundland from 32.1:1 to 25.9:1. In Prince Edward Island the ratio fell from 25.8:1 in 1957-58 to 20.9:1 in 1967-68. During the last two years of this 11-year period there was a sharp decline from 23.0:1 in 1965-66. To avoid an unrealistically steep negative trend, the projection was made on the basis of the nine-year period from 1957-58 to 1965-66. In Nova Scotia the decline in the ratio was from 28.7:1 in 1957-58 to 24.1:1 in 1967-68. In New Brunswick the decline was from 26.8:1 in 1957-58 to 23.5:1 in 1967-68.1/ Least-squares straight-line projections of these trends to 1976-77 give a ratio of about 20:1 for each of the Atlantic Provinces.

Because available data are incomplete, student-teacher ratios had to be based on students and teachers in public schools only. At the same time, school enrolment forecasts are for all schools, including federally-operated and private schools. The effect of this discrepancy is small, however. In the school year 1966-67 public school enrolments constituted over 97 per cent of total school enrolments in each of the four Atlantic Provinces.

1/ Calculated from D.B.S. Salaries and Qualifications of Teachers in Public Elementary and Secondary Schools, and Survey of Elementary and Secondary Education; and from data supplied by D.B.S. Education Division.

Future Numbers of Teachers

Demand Forecast

In Table 4-3 future numbers of teachers are projected for 1971-72 and 1976-77. Also shown are the numbers which would be required in 1981-82 and 1986-87 were student ratios to remain at the 1976-77 level.

In Newfoundland teacher demand rises to a peak in 1976-77; then, assuming a constant pupil-teacher ratio, it remains on a plateau for the next five years, following which it resumes a much slower rate of advance. In the case of Prince Edward Island, absolute numbers are so small that the trend may become obscured. The table shows a constant level of teacher demand through 1976-77 followed by a decline over the ensuing decade. In Nova Scotia the demand rises to a peak in 1976-77 and then declines during the following 10 years. In New Brunswick the peak demand is reached by 1971-72, but it then remains on a plateau during the following five years before commencing a decline that extends over the 1976-86 decade.

TABLE 4-3

School Teacher Demand 1967-68, with Forecasts to 1976-77

Year	Newfoundland	Prince Edward Island	Nova Scotia	New Brunswick
	---------- 000 ----------			
1967-68 Actual*	5.9	1.4	8.7	7.3
1971-72	6.9	1.4	9.4	7.6
1976-77	8.3	1.4	9.8	7.6
1981-82‡	8.2	1.3	8.8	6.9
1986-87‡	8.6	1.2	8.5	6.7

* D.B.S. Education Division.

‡ Assuming student-teacher ratios unchanged from 1976-77.

Loss Rates

For Newfoundland, it was found that the average annual loss of teachers over the five-year period from 1962-63 to 1966-67 was 25.1 per cent with a range from a high of 26.5 per cent to a low of 23.7 per cent. In Prince Edward Island available data permit only a four-year average for the period from 1963-64 to 1966-67. This gave an average of 13.3 per cent and a range from 14.6 per cent to 11.7 per cent. In Nova Scotia, over the

TABLE 4-4

Teacher Losses by Destination, Atlantic Provinces, 1962-63 to 1965-66

Destination	1962-63	1963-64	1964-65	1965-66
	%	%	%	%
Newfoundland				
Teaching outside the province	5	7	5	n.a.
Administrative post in education	12	10	11	n.a.
Housekeeping (married women only)	15	14	15	n.a.
Other non-teaching activities or occupations	30	25	26	n.a.
Further training (academic or professional)	36	42	41	n.a.
Superannuation, illness or death	2	2	2	n.a.
Total	100	100	100	-
Prince Edward Island				
Teaching outside the province	n.a.	18	23	23
Administrative post in education	n.a.	13	6	2
Housekeeping (married women only)	n.a.	29	26	34
Other non-teaching activities or occupations	n.a.	21	21	14
Further training (academic or professional)	n.a.	13	19	24
Superannuation, illness or death	n.a.	5	4	3
Total	-	100	100	100
Nova Scotia				
Teaching outside the province	23	21	23	28
Administrative post in education	9	7	9	3
Housekeeping (married women only)	37	39	35	35
Other non-teaching activities or occupations	9	11	10	7
Further training (academic or professional)	14	13	14	16
Superannuation, illness or death	8	9	9	11
Total	100	100	100	100
New Brunswick				
Teaching outside the province	n.a.	n.a.	15	n.a.
Administrative post in education	n.a.	n.a.	6	n.a.
Housekeeping (married women only)	n.a.	n.a.	38	n.a.
Other non-teaching activities or occupations	n.a.	n.a.	15	n.a.
Further training (academic or professional)	n.a.	n.a.	17	n.a.
Superannuation, illness or death	n.a.	n.a.	9	n.a.
Total	-	-	100	-

n.a. - not available.

Source: D.B.S. Salaries and Qualifications of Teachers in Public Elementary and Secondary Schools.

five years from 1962-63 to 1966-67, the annual average was 12.1 per cent with a range from 13.7 per cent to 10.7 per cent. In New Brunswick three years, 1964-65 to 1966-67, gave an average of 16.5 per cent and a rather wide range from 21.1 per cent to 14.2 per cent.[1/]

Table 4-4 gives a percentage distribution of losses by destination for each of the four provinces.

Newfoundland is shown to have a relatively low percentage of its losses to teaching outside the province and also to housekeeping, the latter, and possibly the former, reflecting the relatively high percentage of males in that province's teaching force. Newfoundland has experienced relatively high losses to non-teaching activities and occupations and also to further training (academic or professional). The latter suggests that, while Newfoundland has a higher rate of annual losses than the Maritime Provinces, there should also be a higher rate of return to the profession after training. Losses to housekeeping, which are relatively high in the Maritimes, appear to an increasing extent not to represent permanent losses to the profession. However, after several years of housekeeping, a woman returning to the profession would require refresher training.

Additional Teachers Required

Total requirements for teachers comprise net increase in numbers plus the replacement of losses. Loss rates for the future in each province are assumed to equal the annual averages shown above. (See Table 4-5.)

While the smallness of the absolute numbers may distort trends, it is clear that replacement demand is much larger than incremental demand. It should also be noted that, even in Newfoundland, requirements during the 1971-76 period are not exceeded during the following decade.

Recruitment Sources

In Newfoundland over the five-year period from 1962-63 to 1966-67 the proportion of total teacher recruitment from among teachers in another province or country averaged 3.0 per cent with a range from a high of 3.6 per cent to a low of 2.3 per cent. Recruitment from educational institutions (mainly Memorial University) averaged 77.9 per cent with a range between 81.8 per cent and 69.8 per cent. Recruitment from other occupational activities (including women returning from housekeeping) averaged 19.1 per cent with a range of from 26.6 per cent to 15.6 per cent.

1/ Calculated from D.B.S. Salaries and Qualifications of Teachers in Public and Elementary Schools, and from data supplied by D.B.S. Education Division.

TABLE 4-5

Annual Average Additions to Teacher Supply, Atlantic Provinces, 1967-68 to 1986-87*

Province and Time Period	Net Increases	Replacement	Total
	-------------	000	------------
Newfoundland			
1967-68 to 1971-72	0.3	1.6	1.9
1971-72 to 1976-77	0.3	1.9	2.2
1976-77 to 1981-82	0.0	2.1	2.1
1981-82 to 1986-87	0.1	2.1	2.2
Prince Edward Island			
1967-68 to 1971-72	0.0	0.2	0.2
1971-72 to 1976-77	0.0	0.2	0.2
1976-77 to 1981-82	0.0	0.2	0.2
1981-82 to 1986-87	0.0	0.2	0.2
Nova Scotia			
1967-68 to 1971-72	0.2	1.1	1.3
1971-72 to 1976-77	0.1	1.2	1.3
1976-77 to 1981-82	-0.2	1.1	0.9
1981-82 to 1986-87	-0.1	1.1	1.0
New Brunswick			
1967-68 to 1971-72	0.1	1.2	1.3
1971-72 to 1976-77	0.0	1.3	1.3
1976-77 to 1981-82	-0.1	1.3	1.2
1981-82 to 1986-87	0.0	1.2	1.2

* Assuming, for the period after 1976-77, that student-teacher ratios remain at the 1976-77 level.

In Prince Edward Island during the four-year period from 1963-64 to 1966-67 the percentage of recruitment from among teachers outside the province averaged 12.4 per cent with a range between 15.2 per cent and 10.2 per cent. Recruitment from educational institutions (mainly within the province) averaged 45.8 per cent with a range between 59.7 per cent and 37.7 per cent. Recruitment from other occupational activities averaged 41.8 per cent with a range between 51.2 per cent and 30.1 per cent.

In Nova Scotia during the five-year period between 1962-63 and 1966-67 the proportion of total teacher recruitment from among teachers outside the province averaged 15.1 per cent with a range between a high of 17.2 per cent and a low of 13.0 per cent. Recruitment from educational institutions (mainly Nova Scotia Teachers' College and universities within the province) averaged 51.5 per cent with a range between 57.7 per cent and 48.1 per cent. Recruitment from other occupational activities averaged 33.4 per cent with a range from a high of 36.3 per cent to a low of 27.4 per cent.

In New Brunswick over the three-year period from 1964-65 to 1966-67 teachers recruited from outside the province averaged 10.4 per cent of the total recruited, with a range between 10.5 per cent and 10.2 per cent. Recruitment from educational institutions (mainly New Brunswick Teachers' College and universities within the province) averaged 60.7 per cent with a range between 61.8 per cent and 58.7 per cent. Recruitment from other occupational activities averaged 29.0 per cent with a range between 31.1 per cent and 27.8 per cent. The range between highs and lows was smaller than in the other provinces, but it should be remembered that, owing to lack of data, the time series consists of only three years compared to five years for Newfoundland and Nova Scotia and four years for Prince Edward Island.1/

In none of the provinces is a trend apparent over these relatively short time series. For purposes of indicating sources of future teacher requirements, it was decided to use the annual average percentages for recent years. This procedure gives the distribution of average annual requirements shown in Table 4-6.

Table 4-6 shows that educational institutions are the main source of teachers. In the late 1970's in Newfoundland, requirements from this source will be smaller than in either the preceding or following period. In the Maritimes, requirements will be less in the late 1970's and early 1980's than in the preceding period. As will appear later, in all four provinces, university and college enrolments (including teachers' colleges) are to rise to or close to their peak by 1981. It

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1/ Calculated from D.B.S. Salaries and Qualifications of Teachers in Public Elementary and Secondary Schools.

TABLE 4-6

Numbers of Annual Teacher Additions by Source
Atlantic Provinces, 1967-68 to 1986-87*

Province and Time Period	Total Requirements	Source: Teachers from Another Province or Country	Source: Educational Institutions	Source: Other Occupational Activities
	000	000	000	000
Newfoundland				
1967-68 to 1971-72	1.9	0.0	1.5	0.4
1971-72 to 1976-77	2.2	0.1	1.6	0.5
1976-77 to 1981-82	2.1	0.1	1.5	0.5
1981-82 to 1986-87	2.2	0.1	1.6	0.5
Prince Edward Island				
1967-68 to 1971-72	0.2	0.0	0.1	0.1
1971-72 to 1976-77	0.2	0.0	0.1	0.1
1976-77 to 1981-82	0.2	0.0	0.1	0.1
1981-82 to 1986-87	0.2	0.0	0.1	0.1
Nova Scotia				
1967-68 to 1971-72	1.3	0.2	0.7	0.4
1971-72 to 1976-77	1.3	0.2	0.7	0.4
1976-77 to 1981-82	0.9	0.1	0.5	0.3
1981-82 to 1986-87	1.0	0.2	0.5	0.3
New Brunswick				
1967-68 to 1971-72	1.3	0.1	0.8	0.4
1971-72 to 1976-77	1.3	0.1	0.8	0.4
1976-77 to 1981-82	1.2	0.1	0.7	0.4
1981-82 to 1986-87	1.2	0.1	0.7	0.4

* Assuming, for the period after 1976-77, that student-teacher ratios remain at the 1976-77 level.

would therefore appear that teacher training may claim a relatively smaller number of the youth population at university in the late 1970's than in either the preceding or the following period. However, to the extent that basic teacher qualifications are raised, this tendency will be offset. After the rapid expansion of enrolments up to 1981, universities may more easily be able to accommodate teachers wishing to return to university to improve their qualifications.

4. FORECASTS OF FULL-TIME POST-SECONDARY ENROLMENTS

Assumptions Underlying the Forecasts

The assumptions underlying these forecasts are discussed in detail in Appendix C. They may be summarized as follows:

1) In universities and colleges (including teachers' colleges) in each of the Atlantic Provinces in 1976-77, it is assumed that foreign students will constitute 5 per cent of total full-time enrolments, and this percentage will hold in 1981-82 and 1986-87. The percentage for 1971-72 is reached through interpolation between the 1967-68 actuals and the 1976-77 forecasts. In 1967-68 the actual percentages were: Newfoundland, 1.4 per cent; Prince Edward Island, 5.7 per cent; Nova Scotia, 8.0 per cent; New Brunswick, 4.9 per cent; and Canada, 5.0 per cent.

2) It is assumed that, by 1976-77, the total number of residents of a given province attending any university or college in Canada will equal total Canadian enrolments in that province. This equality will hold in 1981-82 and 1986-87. The percentages for 1971-72 are reached through interpolation between the 1967-68 actuals and the 1976-77 forecasts. Similarly, residents of a given province enrolled in teachers' colleges are assumed to equal Canadian enrolments in that province's teachers' college throughout the period. In 1967-68 the number of provincial residents at university or college anywhere in Canada as a percentage of Canadian enrolments in the province was: Newfoundland, 113.0 per cent; Prince Edward Island, 121.5 per cent; Nova Scotia, 86.9 per cent; and New Brunswick, 90.0 per cent.

3) It is assumed that the number of provincial residents at university or college anywhere in Canada as a percentage of the provincial population 18-24 years of age in each of the Maritime Provinces will by 1976-77, equal the Canadian average, and this equality will hold in 1981-82 and 1986-87. The percentages for 1971-72 are reached through interpolation between the 1967-68 actuals and the 1976-77 forecasts. In Newfoundland it is assumed that, by 1981-82, the percentage enrolled will be equal to Canada's percentage in 1976-77, and in 1986-87 that province's percentage will equal the Canadian percentage in 1981-82. Percentages for 1971-72 and 1976-77 for Newfoundland are reached through interpolation between the 1967-68 actual and the 1981-82 forecast. The Canadian percentage for 1976-77 is adjusted upward from the projection for 1975-76 by Illing and Zsigmond (1967), which in turn was based on corresponding United States percentages of a decade earlier. Based on the assumptions that Canada will continue to trail the United States by a decade, and that the forecasts for the United States quoted by Illing and Zsigmond will hold, the following percentages of

the population 18-24 enrolled in university or college are projected for Canada: 1976-77, 18.6 per cent; 1981-82, 20.9 per cent; and 1986-87, 23.5 per cent. The actual percentages of the population 18-24 years of age at university in 1967-68 for the Atlantic Provinces and Canada were: Newfoundland, 8.3 per cent; Prince Edward Island, 13.4 per cent; Nova Scotia, 10.5 per cent; New Brunswick, 10.8 per cent; and Canada, 11.8 per cent.

4) By 1975-76, full-time enrolment in post-secondary technician diploma courses at technical institutes is forecast by Illing and Zsigmond (1967) to reach 3.7 per cent of the Canadian population 18-24 years of age. This percentage was adjusted to 3.9 per cent in 1976-77. Based on figures for recent years it was assumed that Newfoundland will trail Canada by five years and that Nova Scotia, New Brunswick and Prince Edward Island will trail Canada by 10 years. The three Maritime Provinces will reach 3.9 per cent of their respective youth populations by 1986-87, and Newfoundland will reach 3.9 per cent of its youth population by 1981-82. Figures for intervening years are reached through interpolation between 3.9 per cent and the 1967-68 actuals. The actual percentages in 1967-68 were: Canada, 1.6 per cent; Newfoundland, 1.1 per cent; Nova Scotia, 0.5 per cent; and New Brunswick, 0.6 per cent.

Forecasts

According to Table 4-7, full-time university and college enrolment in Newfoundland will continue to advance throughout the forecast period, and in 1986-87 will be almost four times as large as in 1967-68. In Prince Edward Island, however, enrolment will reach a peak in 1981-82 and remain on this plateau through 1986-87. In 1981-82 enrolment will be somewhat more than twice as large as in 1967-68. In Nova Scotia, enrolment may be expected to almost reach its peak in 1981-82 but to advance slowly through 1986-87. Between 1967-68 and the 1980's, it will almost double. In New Brunswick also, enrolment will probably near a peak in 1981-82, with a further slow advance through 1986-87. Between 1967-68 and 1981-82 enrolment will almost double, and over the whole period will slightly more than double. Figure 4-2 portrays these projected trends graphically.

Table 4-8 shows full-time enrolment of post-secondary students in technician diploma courses at technical institutes. In Newfoundland, enrolment will continue to rise throughout the period, and in 1981-82 will be almost five times as large as in 1967-68. In Nova Scotia, enrolment is expected to increase six or seven times between 1967-68 and 1981-82, with a further advance through 1986-87. In New Brunswick, 1981-82 enrolment will be five to six times the 1967-68 level and will continue its growth to 1986-87.

TABLE 4-7

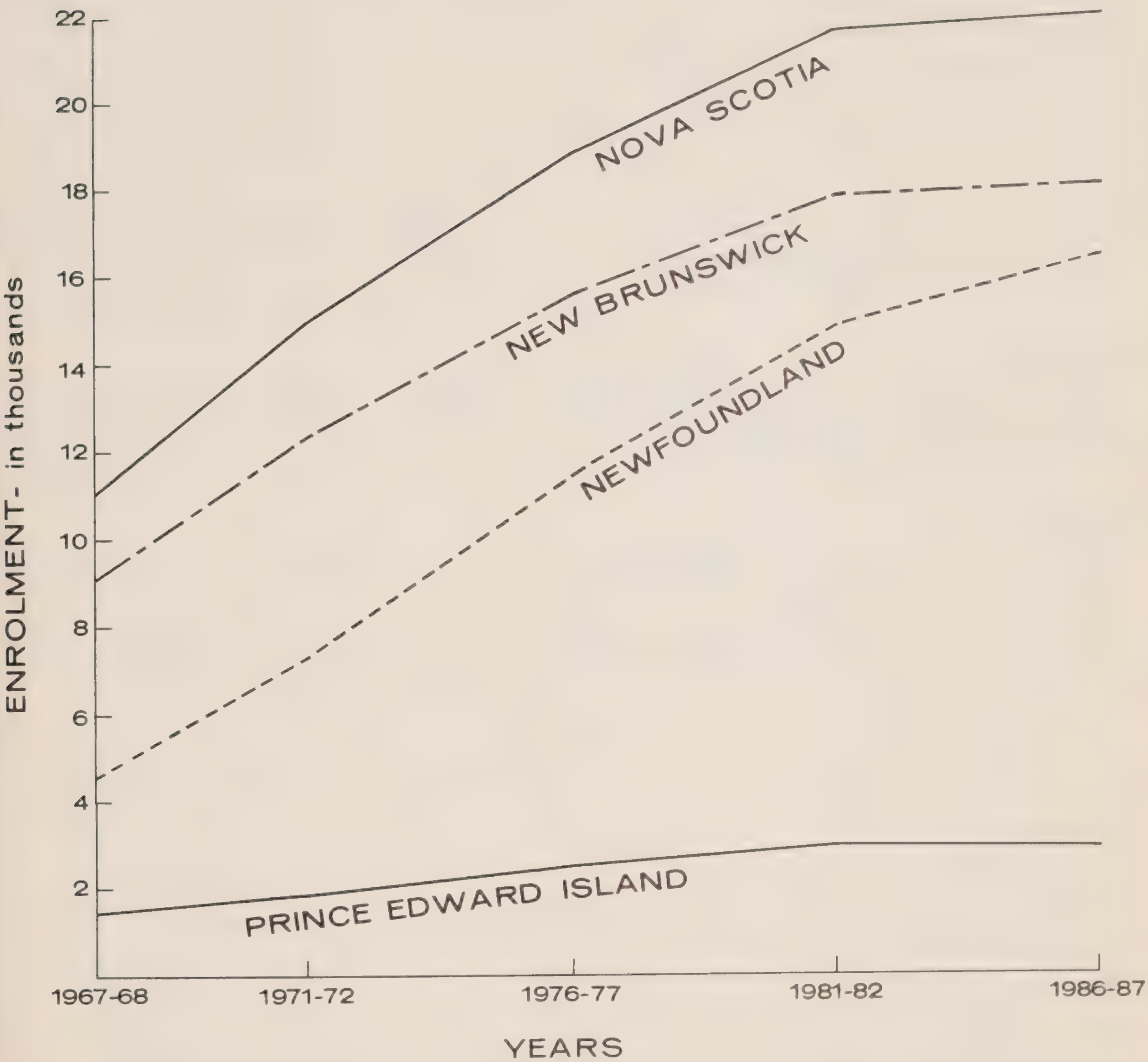
Full-Time Enrolment in Universities and Colleges (Including Teachers' Colleges), Atlantic Provinces, 1967-68 Actual, with Projections to 1986-87

Province and Year	(1) Provincial Residents at University Anywhere in Canada	(2) Total Canadian Enrolment in the Province	(3) Enrolment of Foreign Students in the Province	(4) Total University & College Enrolment in the Province	(5) Population 18-24 Years of Age	(6) Participation Rate (4) as % of (5)
	----------	----------	000	----------	----------	%
Newfoundland						
1967-68	5.0	4.4	0.1	4.5	59.8	8.3
1971-72	7.6	7.0	0.2	7.3	67.6	11.2
1976-77	11.0	11.0	0.6	11.5	73.5	14.9
1981-82	14.2	14.2	0.7	15.0	76.5	18.6
1986-87	15.8	15.8	0.8	16.7	75.7	20.9
Prince Edward Island						
1967-68	1.6	1.3	0.1	1.4	11.7	13.4
1971-72	2.0	1.8	0.1	1.9	12.5	15.7
1976-77	2.4	2.4	0.1	2.5	12.7	18.6
1981-82	2.8	2.8	0.1	2.9	13.3	20.9
1986-87	2.8	2.8	0.1	2.9	11.8	23.5
Nova Scotia						
1967-68	8.9	10.3	0.9	11.2	84.9	10.5
1971-72	13.0	14.1	1.0	15.1	92.3	14.1
1976-77	17.9	17.9	0.9	18.9	96.3	18.6
1981-82	20.8	20.8	1.1	21.8	99.3	20.9
1986-87	21.1	21.1	1.1	22.2	89.6	23.5
New Brunswick						
1967-68	7.8	8.6	0.4	9.1	71.6	10.8
1971-72	11.1	11.8	0.6	12.4	77.6	14.3
1976-77	14.9	14.9	0.8	15.7	80.2	18.6
1981-82	17.1	17.1	0.9	18.0	81.7	20.9
1986-87	17.3	17.3	0.9	18.3	73.8	23.5

NOTE: Figures may not add to totals due to rounding.

FIGURE 4-2

FORECAST OF FULL-TIME ENROLMENTS IN
UNIVERSITIES AND COLLEGES
ATLANTIC PROVINCES, 1967-68 TO 1986-87



Source: Table 4-7

TABLE 4-8

Full-Time Enrolment of Post-Secondary Students in Technician Diploma Courses at Technical Institutes, Atlantic Provinces, 1967-68 Actual and Projections to 1986-87

	Unit	1967-68	1971-72	1976-77	1981-82	1986-87
Newfoundland						
(1) Enrolment	000	0.6	1.3	2.1	3.0	n.a.
(2) Population 18-24	000	59.8	67.6	73.5	76.5	n.a.
(3) Participation Rate: (1) as % of (2)	%	1.1	1.9	2.9	3.9	n.a.
Prince Edward Island						
(1) Enrolment	000	-	0.1	0.2	0.4	0.5
(2) Population 18-24	000	11.7	12.5	12.7	13.3	11.8
(3) Participation Rate: (1) as % of (2)	%	-	0.9	1.9	2.9	3.9
Nova Scotia						
(1) Enrolment	000	0.5	1.1	2.0	3.0	3.5
(2) Population 18-24	000	84.9	92.3	96.3	99.3	89.6
(3) Participation Rate: (1) as % of (2)	%	0.5	1.2	2.1	3.0	3.9
New Brunswick						
(1) Enrolment	000	0.4	1.0	1.8	2.5	2.9
(2) Population 18-24	000	71.6	77.6	80.2	81.7	73.8
(3) Participation Rate: (1) as % of (2)	%	0.6	1.3	2.2	3.1	3.9

In 1981-82, university and college enrolment in Newfoundland is expected to constitute 18.6 per cent of the youth population and enrolment in technical institutes 3.9 per cent, giving a total full-time enrolment in post-secondary education of 22.5 per cent. In the same year, the anticipated percentages for Prince Edward Island are 20.9 per cent and 2.9 per cent respectively, a total of 23.8 per cent. In Nova Scotia, the respective percentages are 20.9 per cent and 3.0 per cent, a total of 23.9 per cent, and in New Brunswick, 20.9 per cent and 3.1 per cent, a total of 24.0 per cent. Thus, Newfoundland will have a somewhat lower percentage of its youth population enrolled in post-secondary education than the Maritime Provinces. Com-

pared to the Maritimes, Newfoundland will have a relatively high proportion of its post-secondary enrolment in technical institutes and a relatively low proportion in universities and colleges.

It should be noted that post-secondary education, as defined here, excludes hospital schools of nursing and post-high school trade courses.

In 1967-68 in Newfoundland, the ratio of university enrolments to technical institute enrolments was 7.5:1, and the ratio of Newfoundlanders enrolled in university anywhere in Canada to technical institute enrolments in Newfoundland was 8:1. The corresponding ratios for Nova Scotia were 22:1 and 18:1 respectively, and for New Brunswick they were 23:1 and 20:1. It is assumed that each province's technical institute enrolment is equal to the number of that province's residents enrolled in technical institutes. Ratio differences for each province represent the unequal inflows and outflows of university students between provinces and the presence of foreign students. By 1986-87, the ratio of university to technical institute enrolments is forecast to be 5:1 in Newfoundland and 7:1 in each of the Maritime Provinces.

Table 4-9 gives the ratio of university to technical institute enrolments in recent years for Canada and Ontario. In both jurisdictions the ratios have been declining and are much lower than in the Atlantic Region, especially the Maritime Provinces.

TABLE 4-9

Ratio of University to Technical Institute Enrolments

Year	Canada	Ontario
1963-64	9:1	9:1
1965-66	8:1	8:1
1967-68	6:1	4:1
1968-69	5:1	3:1

Source: New Brunswick Higher Education Commission. Investing in the Future. Fredericton, January, 1969, p. 49.

A study carried out in 1965 by the Economic Council of Canada indicated that the highest rates of increase in demand for manpower in the five-year period 1965-1970 would occur for university graduates and other post-secondary graduates. University graduates should find a 46-per-cent increase in the demand for their services, and other post-secondary students a 42-per-cent increase. From the second group, graduates of technical institutes would find an 80-per-cent increase in the demand for their services. The study was based on forecasts by 17 companies employing about 5 per cent of the national work force and is not representative of the whole economy, but it is noteworthy that many of the employers not included - governments, the educational system, health and community services, professional firms and partnerships - are the kinds of employers who can be expected to demonstrate even higher levels of demand for professional and semi-professional staff.

The technological changes in our economy make continuous demands for better-trained and more productive manpower, and this is necessarily altering our educational priorities. Wright (1966) described the situation in this way: "In the past, a first degree in engineering could prepare a man for a life's practice, and sub-professional staff could be trained on the job. Today, a first degree can provide only a general kind of education and background .... Sub-professional staff must have formal education and training." He went on to note that graduates from technical institutes formed 38 per cent of the graduating engineers in 1966 while they had formed only 25 per cent of the graduates 10 years earlier.

Starting salaries for technical institute graduates in 1968 were about 15 per cent higher on average than they were the year before, according to the Department of Manpower and Immigration (1968). Graduates in almost all of the 29 specialties listed by the Department could expect to start work at salaries of over $400 per month and in half of the specialties would start at or near the $500 mark.

It is recognized that the application of many branches of technology will be less advanced in the Atlantic Region than in other parts of Canada and that some of the graduates of technicians' courses in the Atlantic Provinces will emigrate, as is the case with some of the graduates of the Region's universities. Concerning this prospect, the views of the New Brunswick Higher Education Commission (1969: p. 51-52) are of interest:

> New Brunswick should focus its efforts on courses which it is particularly suited to offer, regardless of whether the ensuing employment opportunities are now present in this province. Undoubtedly, a number of the graduates of an expanded technical system will move to other parts of the country, as do a large proportion of our university graduates. This is not an acceptable argument,

however, against equipping New Brunswick youth with the kinds of skills they will need. Modern industry requires that education move in parallel with it: if we in this province do not, we will be at an increasing disadvantage. Moreover, to a very considerable extent, employment opportunities create themselves wherever there are well-trained people eager to put their skills to work.

We should also take note of the consequences if we fail to provide enough opportunities for study at the technical level. A very large proportion of the qualified New Brunswick high school graduates now go on to post-secondary studies. But there is only limited scope for students who graduate without university entrance qualifications and (partly in consequence) not enough students stay in high school until completion.

5. FUTURE NUMBERS OF POST-SECONDARY TEACHERS

Student-Teacher Ratios

With the information currently available, the calculation of student-teacher ratios presents formidable problems. Available data on the number of full-time teachers in technical institutes include many who teach both post-secondary students and trade school students. Furthermore, the post-secondary students include both technician diploma students and those taking shorter courses. The only complete data available on enrolments of post-secondary students in technical institutes are for diploma course students. In certain institutions in the Atlantic Provinces there has been a substantial replacement of part-time by full-time teachers, which confuses trends. It was decided, therefore, not to attempt to estimate future numbers of teachers in technical institutes.

The calculation of student-teacher ratios for universities and colleges also presents difficulties. Full-time teaching staff in universities and colleges includes teachers of courses for which junior matriculation is not required. Enrolment data, on the other hand, are confined to post-secondary students. However, this discrepancy is believed not to have a substantial impact on the ratios.

In Prince Edward Island prior to 1965-66, there was a separate teachers' college, but since then all teacher training in the province has been provided at university. The student-teacher ratio has been averaged over the three years subsequent to the closing of the teachers' college. In the other Atlantic Provinces, year-to-year changes in the ratios have fluctuated widely, and trends are not discernible. In the case of all four Atlantic Provinces, therefore, it was decided to base future numbers of teachers on each province's average student-teacher ratio for the three years 1965-66 through 1967-68. These ratios are as follows: Newfoundland, 15.8:1; Prince Edward Island, 14.7:1; Nova Scotia, 12.3:1; and New Brunswick, 14.3:1. For Canada, the most recent three-year period for which the required data are available is the 1963-64 to 1965-66 period, for which the average ratio was 12.9:1. Canadian ratios over the past decade do not yield a clear trend.1/

1/ Illing and Zsigmond (1967); D.B.S. Survey of Higher Education Part II, 1964-65; Canada Year Book (1962-1967); Atlantic Development Board, Stock and Flow ....; Education Division; D.B.S. Census Division.

Forecasts

Table 4-10 gives the number of full-time teachers in universities and colleges (including teachers' colleges) for 1967-68 and projections to 1986-87. Data permitting the calculation of the percentages of teachers leaving the profession in the province are available for only one year, 1967-68, and this particular year is believed not to have been typical in the case of several institutions. Therefore, it was not possible to calculate future teacher requirements.

The number of full-time university and college teachers in Newfoundland will continue to advance through 1986-87, to a level 3.5 times the 1967-68 level. The number of Prince Edward Island teachers will double by 1981-82 and remain there through 1986-87. In Nova Scotia the number of teachers will approach its peak in 1981-82 but will maintain a slow advance through 1986-87. In the early 1980's it will be some 80 per cent above the 1967-68 figure. In New Brunswick also the future number will almost reach its peak in 1981-82 but will continue a slow advance through 1986-87. In the early 1980's it will be over 90 per cent larger than it was in 1967-68.

TABLE 4-10

Full-Time Teachers in Universities and Colleges, (Including Teachers' Colleges), Atlantic Provinces, 1967-68 and Projections to 1986-87

Year	NFLD.	P.E.I.	N.S.	N.B.
	-------------	000	-------------	
1967-68 actual	0.3	0.1	1.0	0.7
Projections:				
1971-72	0.5	0.1	1.2	0.9
1976-77	0.7	0.2	1.5	1.1
1981-82	0.9	0.2	1.8	1.3
1986-87	1.1	0.2	1.8	1.3

6. SUMMARY

During the post-war years all provinces of Canada have been running rapidly to remain in the same place in relation to rapidly rising enrolments. If emigration continues at its recent rates, if urbanization increases and birth rates decline as they have in other provinces, the three Maritime Provinces should, in the years ahead, have an opportunity to consolidate schools and improve the quality of education. The forecast dip in enrolments should make it possible to improve teacher education and pupil programming with relatively small increases in over-all costs.

Newfoundland will continue to have a relatively large child population in relation to the size of its labour force, and school enrolments are to continue to advance through 1986-87. However, age-specific fertility rates in Newfoundland appear to be much higher than in the Maritimes, and they may therefore decline even more dramatically. Should this occur, the problems of improving the quality of education in Newfoundland would be eased.

Educational institutions are the main source of teachers. In Newfoundland in the late 1970's requirements from this source will be smaller than in either the preceding or following period. In the Maritimes, requirements will be less in the late 1970's and early 1980's than in the preceding period. In all four provinces, university and college enrolments (including teachers' colleges) are forecast to rise to or close to their peak by 1981. It would therefore appear that teacher training may draw a relatively smaller proportion of the youth population at university in the late 1970's than in either the preceding or the following periods. However, to the extent that teacher training requirements are increased, this tendency will be offset. After the rapid expansion of enrolments up to 1981, universities may more easily be able to accommodate teachers wishing to return to university to improve their qualifications.

Between the present and the early 1980's university enrolments are expected to increase to about three and one-half times present levels in Newfoundland and to about double in each of the Maritime Provinces. University teacher demand should grow at about the same rates. Enrolments in technical institutes will probably increase significantly more rapidly - by about five times in Newfoundland and by six to seven times in Nova Scotia and New Brunswick. In Prince Edward Island, where technician training has not as yet been inaugurated, an increase of four to five times is forecast for the period between 1971 and the early 1980's. At present the ratio of university to technical institute enrolments in Newfoundland is 7.5:1; in Nova Scotia it is 22:1; and in New Brunswick 23:1. In 1981-82 the ratio for Newfoundland is expected to decline to 5:1, and for each of the Maritime Provinces to about 7:1.

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in the
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APPENDIX A

APPENDIX A

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TABLE A-1

Size of Families and Households in Canada, the Provinces, and in Subdivisions of the Atlantic Provinces, 1961

Division	% Households with 2 or More Families	Persons per Household	Children per Family	Extra Persons per Household*
CANADA	3.7	3.9	1.9	0.0
NEWFOUNDLAND	7.5	5.0	2.7	0.3
Division 1	7.1	4.9	2.5	0.4
2	5.5	5.0	2.8	0.2
3	10.4	5.2	2.6	0.6
4	5.1	5.6	3.5	0.1
5	7.6	5.3	2.9	0.4
6	9.4	5.5	2.9	0.6
7	9.4	4.7	2.3	0.4
8	6.6	5.1	2.7	0.4
9	8.2	5.6	3.1	0.5
10	5.6	5.0	2.7	0.3
PRINCE EDWARD ISLAND	5.0	4.2	2.2	0.0
Kings	4.4	4.2	2.2	0.0
Prince	4.8	4.4	2.3	0.1
Queens	5.5	4.1	2.0	0.1
NOVA SCOTIA	4.8	4.0	2.0	0.0
Annapolis	2.7	3.6	1.7	-0.1
Antigonish	3.8	5.0	2.9	0.1
Cape Breton	6.0	4.6	2.3	0.3
Colchester	3.7	3.8	1.8	0.0
Cumberland	4.2	3.7	1.8	-0.1
Digby	4.2	3.8	1.9	-0.1
Guysborough	4.4	4.1	2.1	0.0
Halifax	5.2	4.1	1.9	0.2
Hants	3.9	4.0	2.0	0.0
Inverness	5.5	4.6	2.5	0.1
Kings	3.2	3.9	1.9	0.0
Lunenburg	4.7	3.5	1.5	0.0
Pictou	3.5	3.8	1.9	-0.1
Queens	4.8	3.8	1.8	0.0
Richmond	9.0	4.5	2.3	0.2
Shelburne	4.6	3.8	1.9	-0.1
Victoria	4.8	4.2	2.2	0.0
Yarmouth	4.9	3.9	1.9	0.0
NEW BRUNSWICK	4.6	4.4	2.3	0.1
Albert	3.1	4.0	2.0	0.0
Carleton	3.6	4.0	2.0	0.0
Charlotte	3.4	3.5	1.6	-0.1
Gloucester	7.5	5.6	3.2	0.4
Kent	7.7	5.2	2.8	0.4
Kings	2.9	3.7	1.8	-0.1
Madawaska	5.0	5.3	3.1	0.2
Northumberland	6.2	4.8	2.6	0.2
Queens	3.1	3.8	2.0	-0.2
Restigouche	5.7	5.0	2.8	0.2
Saint John	2.8	3.8	1.8	0.0
Sunbury	2.6	4.4	2.4	0.0
Victoria	2.9	4.5	2.6	-0.1
Westmorland	5.2	4.2	2.1	0.1
York	4.3	3.9	1.8	0.1
QUÉBEC	3.3	4.2	2.2	0.0
ONTARIO	4.6	3.7	1.6	0.1
MANITOBA	3.1	3.7	1.7	0.0
SASKATCHEWAN	1.9	3.6	1.8	-0.2
ALBERTA	2.1	3.7	1.8	-0.1
BRITISH COLUMBIA	2.3	3.4	1.6	-0.2

* Other than one average family of two parents plus children.

Source: Derived from Census of Canada, 1961.

TABLE A-2

Per Cent of Population in Small Communities and in Urban Communities, Canada, Provinces, and Atlantic Subdivisions, 1961 (1951)

Division	% Rural Non-Farm		% Urban		% in Places of 10,000 Plus		% in Places of 100,000 Plus	
CANADA	19	(18)	70	(62)	59	(45)	43	(24)
NEWFOUNDLAND	47	(53)	51	(43)	29	(15)	-	-
Division 1	35	(35)	62	(60)	51	(35)	-	-
2	61	(77)	36	(22)	-	-	-	-
3	65	(87)	35	(13)	-	-	-	-
4	50	(40)	43	(25)	-	-	-	-
5	24	(23)	75	(73)	64	-	-	-
6	23	(20)	77	(80)	32	-	-	-
7	71	(81)	27	(17)	-	-	-	-
8	80	(89)	18	(9)	-	-	-	-
9	84	(90)	14	(8)	-	-	-	-
10	56	(100)	44	-	-	-	-	-
PRINCE EDWARD ISLAND	35	(27)	32	(25)	18	(16)	-	-
Kings	44	(25)	15	(13)	-	-	-	-
Prince	44	(35)	24	(17)	-	-	-	-
Queens	22	(22)	47	(37)	40	(37)	-	-
NOVA SCOTIA	38	(29)	54	(54)	44	(28)	38	-
Annapolis	71	(53)	13	(12)	-	-	-	-
Antigonish	45	(19)	30	(27)	-	-	-	-
Cape Breton	15	(16)	83	(79)	81	(56)	-	-
Colchester	38	(38)	49	(37)	46	(34)	-	-
Cumberland	34	(24)	53	(54)	29	-	-	-
Digby	77	(55)	11	(10)	-	-	-	-
Guysborough	70	(57)	17	(18)	-	-	-	-
Halifax	23	(16)	76	(83)	75	(62)	75	-
Hants	63	(49)	20	(20)	-	-	-	-
Inverness	55	(19)	19	(25)	-	-	-	-
Kings	58	(40)	28	(28)	-	-	-	-
Lunenburg	60	(45)	25	(24)	-	-	-	-
Pictou	28	(18)	61	(62)	51	-	-	-
Queens	68	(46)	28	(44)	-	-	-	-
Richmond	89	(78)	-	-	-	-	-	-
Shelburne	74	(66)	24	(30)	-	-	-	-
Victoria	86	(55)	-	-	-	-	-	-
Yarmouth	55	(37)	37	(41)	-	-	-	-
NEW BRUNSWICK	43	(30)	47	(42)	33	(25)	-	-
Albert	58	(72)	31	-	31	-	-	-
Carleton	51	(34)	23	(22)	-	-	-	-
Charlotte	61	(45)	34	(41)	-	-	-	-
Gloucester	70	(39)	20	(10)	-	-	-	-
Kent	65	(40)	11	(5)	-	-	-	-
Kings	58	(25)	19	(38)	6	-	-	-
Madawaska	39	(35)	44	(36)	33	(31)	-	-
Northumberland	62	(40)	30	(25)	-	-	-	-
Queens	71	(63)	12	-	-	-	-	-
Restigouche	40	(27)	51	(45)	29	-	-	-
Saint John	12	(2)	88	(98)	88	(98)	-	-
Sunbury	35	(46)	59	(19)	53	-	-	-
Victoria	53	(42)	27	(20)	-	-	-	-
Westmorland	31	(23)	61	(57)	55	(34)	-	-
York	32	(27)	58	(48)	47	(38)	-	-
QUÉBEC	15	(15)	76	(67)	63	(48)	50	(29)
ONTARIO	15	(15)	77	(71)	67	(55)	48	(28)
MANITOBA	18	(16)	64	(57)	56	(44)	51	(30)
SASKATCHEWAN	24	(22)	43	(30)	27	(20)	12	-
ALBERTA	15	(16)	63	(48)	51	(35)	46	(24)
BRITISH COLUMBIA	23	(23)	73	(68)	63	(55)	53	(30)

Source: Derived from Census of Canada, 1961 and 1951. Since the definition of the various classifications changed slightly, comparisons between 1961 and 1951 should be made with care, especially for subdivisions and where percentages differ only by several points. Generally, the later classifications favour non-farm at the expense of farm, urban at the expense of rural, and larger urban at the expense of smaller urban.

TABLE A-3

Some Characteristics of the Male Work Force, Canada, Provinces, and Atlantic Subdivisions, 1961

Division	% of Population Aged 20-64	Male Labour Force as % of Males 20-64	% Male Work Force in Professions	% Male Wage Earners Regularly Employed*	Annual Average Male Salaries and Wages
CANADA	50.6	101.2	7.6	71.7	$3,679
NEWFOUNDLAND	42.7	86.8	5.4	55.1	2,823
Division 1	44.3	87.4	6.4	62.6	2,977
2	39.8	86.4	3.7	46.6	1,958
3	41.5	92.4	3.3	48.0	1,931
4	37.6	89.2	3.2	53.4	2,651
5	42.2	98.0	5.1	61.7	3,305
6	42.0	100.0	5.6	64.5	3,589
7	43.1	80.3	4.6	28.1	1,873
8	40.6	77.0	4.9	25.6	1,889
9	39.4	75.9	4.8	25.9	1,750
10	51.2	73.1	6.8	76.3	4,175
PRINCE EDWARD ISL.	45.0	106.9	3.9	56.4	2,359
Kings	44.0	105.9	2.3	33.5	1,552
Prince	43.5	107.2	2.8	57.1	2,422
Queens	46.8	107.1	5.3	62.7	2,547
NOVA SCOTIA	47.9	99.5	5.3	69.0	3,021
Annapolis	46.5	113.5	3.0	59.5	2,463
Antigonish	41.3	100.3	7.7	53.9	2,496
Cape Breton	45.7	95.6	4.1	67.4	3,236
Colchester	47.5	102.7	5.0	66.6	2,698
Cumberland	47.5	92.7	4.9	56.3	2,357
Digby	45.8	96.0	3.7	51.2	1,931
Guysborough	44.2	94.2	2.5	44.4	1,904
Halifax	51.5	103.3	7.4	81.1	3,595
Hants	45.7	96.6	4.3	61.5	2,463
Inverness	42.9	99.1	3.6	40.1	2,037
Kings	48.2	102.7	4.7	72.3	2,928
Lunenburg	50.3	98.1	3.6	57.9	2,320
Pictou	46.4	92.6	4.5	60.0	2,622
Queens	48.1	96.4	4.8	61.0	2,784
Richmond	43.3	95.8	3.2	44.9	2,248
Shelburne	45.8	100.5	3.7	60.5	2,056
Victoria	44.6	92.2	3.7	44.8	2,013
Yarmouth	45.9	95.2	4.8	62.9	2,281
NEW BRUNSWICK	45.2	97.4	5.6	61.8	2,807
Albert	47.1	98.5	5.7	73.3	3,375
Carleton	45.1	102.1	3.9	53.9	2,125
Charlotte	48.3	100.2	4.0	60.2	2,328
Gloucester	38.5	90.6	4.4	33.5	2,017
Kent	39.9	93.3	2.3	29.6	1,559
Kings	46.3	102.9	6.0	63.4	2,819
Madawaska	40.9	97.9	5.5	49.9	2,659
Northumberland	42.4	91.6	3.8	54.0	2,406
Queens	45.9	98.6	3.0	59.9	2,377
Restigouche	42.2	92.0	5.3	53.8	2,812
Saint John	50.7	97.3	6.9	75.2	3,303
Sunbury	46.2	108.9	1.4	82.2	3,164
Victoria	42.0	97.7	4.0	44.9	2,154
Westmorland	47.5	97.6	7.1	71.4	3,188
York	49.6	102.3	8.9	67.2	3,059
QUÉBEC	49.9	99.2	-	69.6	3,469
ONTARIO	52.7	103.0	-	75.9	3,984
MANITOBA	50.7	104.1	-	72.0	3,574
SASKATCHEWAN	48.8	106.4	-	67.3	3,290
ALBERTA	50.3	104.1	-	71.6	3,733
BRITISH COLUMBIA	51.7	98.8	-	70.5	4,004

* Regularly employed means at least 40 weeks annually, at least 35 hours weekly.

Source: Derived from Census of Canada, 1961.

TABLE A-4

Some Characteristics of the Female Work Force,
Canada, Provinces, and Atlantic Subdivisions, 1961

Division	Female Labour Force as % of Females 20-64	% Female Work Force in Professions	% Female Wage Earners Regularly Employed*	Annual Average Female Salaries and Wages
CANADA	38.6	15.4	59.1	$1,995
NEWFOUNDLAND	25.3	19.8	54.9	1,446
Division 1	31.4	21.3	58.7	1,536
2	17.8	22.6	43.4	1,051
3	16.8	15.7	49.1	892
4	27.6	17.7	49.0	1,495
5	28.2	16.9	55.8	1,403
6	24.8	17.9	55.3	1,511
7	13.8	20.9	42.1	997
8	15.7	19.5	42.6	909
9	14.4	17.7	38.4	829
10	26.8	12.9	63.4	2,432
PRINCE EDWARD ISL.	35.5	19.7	47.4	1,285
Kings	31.0	19.8	24.2	939
Prince	31.8	19.0	45.0	1,215
Queens	40.0	20.2	54.9	1,418
NOVA SCOTIA	33.6	20.3	56.3	1,607
Annapolis	27.1	18.5	47.9	1,376
Antigonish	44.4	32.6	56.2	1,350
Cape Breton	28.9	25.1	54.2	1,574
Colchester	39.7	16.3	57.9	1,484
Cumberland	30.0	17.3	49.1	1,320
Digby	25.6	17.6	45.8	1,204
Guysborough	25.6	19.5	42.9	1,135
Halifax	41.4	19.0	62.4	1,886
Hants	28.0	24.8	56.3	1,425
Inverness	30.7	23.9	38.0	1,144
Kings	30.5	19.7	54.7	1,515
Lunenburg	24.4	17.1	47.7	1,203
Pictou	31.4	22.6	54.6	1,404
Queens	26.2	17.7	46.9	1,249
Richmond	26.0	20.9	44.6	1,270
Shelburne	27.1	16.3	40.3	1,149
Victoria	25.2	28.7	39.9	1,300
Yarmouth	31.4	16.1	53.2	1,253
NEW BRUNSWICK	34.1	19.8	53.4	1,569
Albert	27.0	20.4	56.4	1,661
Carleton	26.7	23.4	48.4	1,348
Charlotte	36.2	14.8	48.7	1,319
Gloucester	29.5	24.0	35.8	1,148
Kent	27.9	19.0	31.3	872
Kings	27.8	21.4	53.9	1,578
Madawaska	33.3	23.9	50.2	1,331
Northumberland	26.2	28.1	48.0	1,446
Queens	21.0	24.6	40.0	1,454
Restigouche	33.4	23.5	55.0	1,499
Saint John	42.5	16.4	61.7	1,795
Sunbury	17.2	16.9	47.6	1,646
Victoria	24.6	26.6	44.7	1,436
Westmorland	41.4	17.2	57.0	1,669
York	38.6	18.9	57.6	1,758
QUÉBEC	36.2	-	62.7	1,920
ONTARIO	42.4	-	59.4	2,119
MANITOBA	41.7	-	58.4	1,902
SASKATCHEWAN	35.3	-	56.9	1,974
ALBERTA	39.5	-	55.8	2,001
BRITISH COLUMBIA	37.6	-	55.5	2,096

* Regularly employed means at least 40 weeks annually, at least 35 hours weekly.

Source: Derived from Census of Canada, 1961.

TABLE A-5

Per Cent of Population Migrating,* for Canada and Atlantic Provinces and Subdivisions, 1961-66, 1956-61 and 1951-56

Division	Net Migration 1961-66	1956-61	1951-56
	%	%	%
CANADA	1.4	3.0	4.3
NEWFOUNDLAND	-5.2	-3.9	0.5
Division 1	-5.8	-1.9	0.9
2	-9.5	-8.6	-3.7
3	-4.4	-6.7	-7.0
4	-17.9	-5.0	-2.7
5	-5.9	-5.7	6.8
6	-3.9	-3.7	6.0
7	-10.1	-10.0	-4.9
8	1.6	-0.3	0.2
9	-10.4	-10.3	-2.8
10	29.2	5.6	21.8
PRINCE EDWARD ISLAND	-4.4	-3.3	-8.2
Kings	-6.0	-6.3	-8.2
Prince	-6.6	-3.6	-10.7
Queens	-1.8	-1.9	-6.0
NOVA SCOTIA	-5.5	-3.3	-1.7
Annapolis	-9.7	-3.0	-7.2
Antigonish	-5.2	-0.5	-2.6
Cape Breton	-9.7	-5.4	-7.4
Colchester	-2.4	-8.6	1.4
Cumberland	-9.2	-10.1	-7.4
Digby	-7.7	-5.1	-7.8
Guysborough	-9.6	-10.4	-10.4
Halifax	-2.4	1.5	9.3

Division	Net Migration 1961-66	1956-61	1951-56
NOVA SCOTIA (cont.)	%	%	%
Hants	-6.9	-3.2	-2.5
Inverness	-8.6	-3.5	-7.8
Kings	-6.1	-1.3	3.3
Lunenburg	-0.8	-2.9	-2.3
Pictou	-3.4	-7.7	-6.3
Queens	-8.1	-3.8	-5.3
Richmond	-9.0	-3.6	-6.9
Shelburne	-1.1	-4.2	-6.3
Victoria	-9.7	-5.7	-8.1
Yarmouth	-5.8	-2.6	-9.1
NEW BRUNSWICK	-5.7	-3.0	-4.0
Albert	3.0	5.1	1.2
Carleton	-7.4	-6.4	-6.3
Charlotte	-3.7	-10.3	-9.2
Gloucester	-5.4	-9.8	-4.4
Kent	-15.0	-13.3	-10.2
Kings	3.7	0.3	1.3
Madawaska	-13.3	-7.5	-7.0
Northumberland	-6.9	-7.0	-3.6
Queens	-12.3	-16.0	-9.6
Restigouche	-10.2	-10.2	-5.7
Saint John	-4.2	0.9	0.3
Sunbury	-2.3	94.3	2.1
Victoria	-10.0	-9.5	-11.6
Westmorland	-6.4	-0.7	-4.5
York	-1.8	1.7	1.0

* The minus sign indicates migration from the area.

Source: 1951-56: K. Levitt, Population Movements in the Atlantic Provinces, Fredericton, N.B., A.P.E.C. 1960; 1956-61: Census of Canada, 1961. 1961-66: Supplied by Census Division, D.B.S.

TABLE A-6

Population Increases (Per Cent) in Subdivisions of the Atlantic Provinces, by Decades in Census Years, 1881-1961, and 1961-66

Division	1871 -1881	1881 -1891	1891 -1901	1901 -1911	1911 -1921	1921 -1931	1931 -1941	1941 -1951	1951 -1961	1961 -1966
CANADA	17	11	11	34	22	18	10	22	30	10
NEWFOUNDLAND									27	8
Division 1									26	5
2									11	4
3									14	10
4									51	5
5									39	8
6									36	11
7									12	-1
8									21	11
9									27	9
10									72	56
PRINCE EDWARD ISLAND	16	*	-5	-9	-5	-1	8	4	6	4
Kings	15	1	-7	-8	-10	-6	1	-8	*	1
Prince	21	6	-3	-7	-4	9	*	9	8	4
Queens	13	-4	-6	-11	-4	2	10	4	7	4
NOVA SCOTIA	14	2	2	7	6	-2	13	11	15	3
Annapolis	14	-6	-3	-1	-2	-10	9	23	4	-5
Antigonish	9	-11	-15	-12	-3	-13	5	14	12	4
Cape Breton	18	10	44	49	18	7	20	9	9	-1
Colchester	15	2	-8	-5	6	-1	20	5	9	4
Cumberland	16	26	5	12	2	-12	9	*	-5	-5
Digby	17	*	2	-1	-3	-6	6	3	1	-2
Guysborough	8	-3	7	-7	-9	*	-1	-8	-7	-3
Halifax	19	5	5	7	21	3	22	32	39	9
Hants	10	-6	-9	-2	*	-2	14	6	13	2
Inverness	10	1	-6	5	-7	-12	-2	-11	2	-3
Kings	9	-4	-2	-1	9	3	19	15	26	4
Lunenburg	20	9	4	3	1	-6	4	1	5	3
Pictou	11	-3	-3	7	14	-4	5	8	*	1
Queens	*	*	-4	-1	-2	7	13	4	5	-3
Richmond	6	-5	-6	-2	-6	-11	-2	-1	5	-1
Shelburne	20	*	-5	-1	-4	-7	6	9	5	7
Victoria	10	*	-15	-6	-10	-11	1	2	1	-3
Yarmouth	15	4	3	2	-4	-6	7	2	5	1
NEW BRUNSWICK	12	*	3	6	10	5	12	13	16	3
Albert	16	-11	*	-11	-11	-11	10	18	26	12
Carleton	17	-4	-4	-1	-2	-1	4	3	5	-1
Charlotte	1	-9	-6	-6	1	*	7	11	-7	1
Gloucester	15	15	12	17	18	8	19	15	15	6
Kent	18	5	*	2	-2	-2	10	4	*	-7
Kings	4	-10	-6	-5	-1	-3	9	4	15	10
Madawaska	20	21	17	35	21	22	15	22	14	-4
Northumberland	25	2	11	9	9	*	13	12	16	3
Queens	1	-13	-8	-3	7	-4	14	3	-12	-6
Restigouche	27	18	27	48	46	31	11	9	13	*
Saint John	2	-6	4	4	13	2	12	8	20	-4
Sunbury	-3	-13	-1	9	-1	14	19	12	145	10
Victoria	59	10	15	31	11	16	12	11	6	*
Westmorland	29	10	1	6	20	8	12	24	17	2
York	12	2	2	*	2	1	12	17	24	11
QUÉBEC										10
ONTARIO										12
MANITOBA										4
SASKATCHEWAN										3
ALBERTA										10
BRITISH COLUMBIA										15

* Denotes change of less than 1.0 per cent.

Source: Derived from Census of Canada.

TABLE A-7

Percentages of the Population Five Years of Age and Over not Attending School, by Level of Schooling, 1961

Division	No Schooling	Having Less than Grade 5	Some University or University Degree
CANADA	5.7	13.4	5.8
NEWFOUNDLAND	11.0	28.8	3.0
Division 1	8.4	21.3	3.8
2	13.9	37.7	1.9
3	17.1	44.5	1.3
4	15.5	34.5	2.5
5	10.4	24.1	3.4
6	8.3	21.4	4.2
7	11.9	37.8	1.4
8	12.5	38.9	1.3
9	16.7	43.6	1.2
10	17.2	33.7	4.5
PRINCE EDWARD ISLAND	6.1	12.3	4.1
Kings	6.3	13.4	2.0
Prince	6.8	14.5	2.8
Queens	5.5	10.1	6.0
NOVA SCOTIA	4.3	11.0	5.0
Annapolis	3.5	8.1	4.7
Antigonish	5.2	12.4	8.7
Cape Breton	4.9	12.5	3.6
Colchester	3.2	7.3	4.4
Cumberland	4.1	10.8	3.6
Digby	4.7	16.3	3.0
Guysborough	6.5	20.9	2.2
Halifax	4.0	8.1	7.5
Hants	4.0	10.3	3.9
Inverness	5.9	19.1	2.9
Kings	4.1	8.9	6.1
Lunenburg	3.7	14.8	2.8
Pictou	3.4	8.9	3.5
Queens	5.2	15.4	3.9
Richmond	7.1	24.3	1.9
Shelburne	3.8	12.5	2.5
Victoria	5.2	14.8	2.7
Yarmouth	4.9	14.2	3.2
NEW BRUNSWICK	8.8	19.0	4.3
Albert	6.6	11.4	5.8
Carleton	6.7	12.4	4.1
Charlotte	5.3	9.7	4.1
Gloucester	15.3	37.7	2.4
Kent	12.8	34.2	1.4
Kings	5.8	11.3	5.8
Madawaska	13.3	30.7	3.9
Northumberland	9.8	21.7	3.1
Queens	6.5	16.1	3.1
Restigouche	14.3	29.3	3.1
Saint John	5.7	10.8	5.0
Sunbury	8.8	16.1	3.3
Victoria	10.4	22.4	4.0
Westmorland	6.8	14.2	5.3
York	5.7	11.0	6.7
QUÉBEC	6.4	17.9	5.2
ONTARIO	3.9	9.0	6.0
MANITOBA	6.6	14.6	5.9
SASKATCHEWAN	7.8	15.5	4.9
ALBERTA	7.0	12.5	6.7
BRITISH COLUMBIA	5.3	9.7	8.0

Source: Derived from Census of Canada, 1961.

TABLE A-8

Distribution, by Type of Industry, of the Male Labour Force, Atlantic Provinces and Subdivisions, 1961

Division	Primary	Secondary	Tertiary
CANADA	17.5	32.3	47.8
NEWFOUNDLAND	23.7	22.8	50.4
Division 1	12.8	23.0	61.3
2	37.8	26.4	31.9
3	33.0	19.7	43.3
4	27.9	15.2	54.8
5	14.9	38.3	44.1
6	19.1	28.4	49.9
7	33.1	24.6	39.0
8	52.5	11.1	31.0
9	61.3	9.7	25.5
10	14.7	13.7	70.8
PRINCE EDWARD ISLAND	41.1	16.6	40.3
Kings	57.2	16.8	24.1
Prince	41.9	14.6	41.2
Queens	34.1	18.1	46.0
NOVA SCOTIA	18.6	24.6	55.1
Annapolis	21.1	16.6	61.0
Antigonish	27.2	24.3	46.5
Cape Breton	30.9	25.5	42.2
Colchester	19.0	27.4	52.0
Cumberland	27.5	26.4	42.8
Digby	27.2	28.2	42.3
Guysborough	37.4	25.9	35.0
Halifax	2.8	19.8	75.8
Hants	28.8	29.0	40.5
Inverness	43.4	18.5	35.3
Kings	20.2	20.6	58.0
Lunenburg	21.9	36.1	40.2
Pictou	22.3	32.4	43.3
Queens	15.2	46.8	36.5
Richmond	24.1	39.1	34.8
Shelburne	36.9	29.8	32.5
Victoria	40.7	13.0	44.8
Yarmouth	23.6	30.0	44.5
NEW BRUNSWICK	20.6	25.9	51.5
Albert	10.8	25.2	62.1
Carleton	40.0	18.9	39.9
Charlotte	25.7	32.3	40.0
Gloucester	38.8	29.1	29.4
Kent	46.2	20.5	31.9
Kings	26.4	27.2	44.4
Madawaska	34.3	24.9	38.2
Northumberland	21.4	23.9	52.5
Queens	41.3	19.9	37.1
Restigouche	24.5	24.6	48.1
Saint John	1.5	34.6	61.8
Sunbury	13.1	4.8	80.4
Victoria	39.1	19.0	40.3
Westmorland	8.7	26.3	63.0
York	17.4	20.6	60.1
QUÉBEC	14.3	36.8	46.0
ONTARIO	12.0	38.5	47.1
MANITOBA	24.2	22.8	50.8
SASKATCHEWAN	45.5	11.9	40.5
ALBERTA	30.0	19.6	48.2
BRITISH COLUMBIA	12.4	31.8	52.9

Source: Derived from Census of Canada, 1961.

TABLE A-9

Percentages of Population Born In and Outside Province of Residence, for Canada, Provinces and Atlantic Subdivisions, 1961

Division	In Their Province	Elsewhere In Canada	Outside Canada
CANADA	74.0	10.4	15.6
NEWFOUNDLAND	96.5	2.1	1.4
Division 1	96.4	1.9	1.7
2	98.8	0.6	0.6
3	98.7	1.0	0.3
4	96.8	2.0	1.2
5	96.5	1.8	1.7
6	95.5	2.9	1.6
7	98.9	0.5	0.6
8	98.7	0.7	0.6
9	99.1	0.3	0.6
10	73.8	21.0	5.2
PRINCE EDWARD ISLAND	89.5	7.6	2.9
Kings	92.1	5.6	2.3
Prince	88.1	9.4	2.5
Queens	89.7	6.9	3.4
NOVA SCOTIA	85.3	10.1	4.6
Annapolis	81.5	12.9	5.6
Antigonish	90.9	4.2	4.9
Cape Breton	88.2	7.5	4.3
Colchester	88.3	7.6	4.1
Cumberland	85.3	10.7	4.0
Digby	93.4	3.7	2.9
Guysborough	94.8	3.2	2.0
Halifax	76.7	17.0	6.3
Hants	92.2	4.3	3.5
Inverness	93.4	3.7	2.9
Kings	80.7	13.6	5.7
Lunenburg	94.1	3.5	2.4
Pictou	88.9	6.9	4.2
Queens	92.7	4.2	3.1
Richmond	94.6	3.7	1.7
Shelburne	93.3	3.9	2.8
Victoria	92.5	4.4	3.1
Yarmouth	93.6	3.5	2.9
NEW BRUNSWICK	86.7	9.4	3.9
Albert	81.6	14.3	4.1
Carleton	90.9	3.8	5.3
Charlotte	86.2	6.5	7.3
Gloucester	96.2	3.0	0.8
Kent	96.7	2.0	1.3
Kings	85.7	8.3	6.0
Madawaska	89.2	7.7	3.1
Northumberland	89.9	7.8	2.3
Queens	90.7	4.4	4.9
Restigouche	86.9	11.5	1.6
Saint John	83.9	10.8	5.3
Sunbury	54.2	38.0	7.8
Victoria	90.8	4.4	4.8
Westmorland	83.9	12.6	3.5
York	85.9	8.4	5.7
QUÉBEC	88.4	4.2	7.4
ONTARIO	69.0	9.3	21.7
MANITOBA	68.7	12.9	18.4
SASKATCHEWAN	71.9	12.0	16.1
ALBERTA	59.2	19.1	21.7
BRITISH COLUMBIA	46.7	27.3	26.0

Source: Derived from Census of Canada, 1961.

TABLE A-10

Percentages of Population in Atlantic Provinces and Subdivisions Speaking French Only, Bilingual, and Roman Catholic

Division	% Speaking Only French	% Bilingual (F. and E.)	% Roman Catholic
CANADA	19.1	12.2	45.7
NEWFOUNDLAND	0.1	1.2	35.7
Division 1	-	0.7	48.5
2	-	0.2	45.6
3	-	0.1	18.1
4	0.5	7.9	76.1
5	-	0.8	29.7
6	-	0.8	29.5
7	-	0.2	9.3
8	-	0.4	9.8
9	-	0.3	15.8
10	2.3	7.2	27.4
PRINCE EDWARD ISLAND	1.2	7.6	46.1
Kings	0.2	1.6	51.9
Prince	2.5	15.3	50.0
Queens	0.3	3.0	40.4
NOVA SCOTIA	0.8	6.1	35.3
Annapolis	0.1	2.6	10.2
Antigonish	0.7	10.9	88.1
Cape Breton	0.1	2.8	59.5
Colchester	0.1	1.4	8.2
Cumberland	0.2	3.2	18.0
Digby	8.0	32.5	54.0
Guysborough	0.5	5.8	38.1
Halifax	0.2	5.1	35.9
Hants	0.1	1.3	10.4
Inverness	9.4	15.7	72.6
Kings	0.1	2.9	12.2
Lunenburg	-	0.9	3.6
Pictou	0.1	2.0	24.8
Queens	0.1	1.2	8.2
Richmond	5.3	46.6	84.1
Shelburne	0.1	1.0	4.7
Victoria	0.1	1.4	38.7
Yarmouth	4.0	31.2	51.6
NEW BRUNSWICK	18.7	19.0	51.9
Albert	0.1	2.4	9.2
Carleton	0.1	1.7	11.4
Charlotte	0.3	3.8	15.6
Gloucester	59.0	29.0	93.3
Kent	45.7	38.1	90.5
Kings	0.1	2.5	14.1
Madawaska	66.5	30.3	97.6
Northumberland	13.2	15.6	59.6
Queens	0.5	5.2	14.1
Restigouche	32.2	35.0	81.4
Saint John	0.7	8.0	38.1
Sunbury	1.3	11.4	33.3
Victoria	17.5	23.4	52.8
Westmorland	10.9	32.9	53.0
York	0.4	4.0	17.1

Source: Derived from Census of Canada, 1961.

TABLE A-11

Three Measures of Educational Input in Canadian Provinces and Atlantic Subdivisions

Division	Per Pupil Expenditure on Teachers' Salaries	Per Cent of All Teachers With 2 Yrs. Training or Less	Per Cent of Elementary Teachers with 2 Yrs. Training or Less
	$	%	%
NEWFOUNDLAND	112	81	92
Division 1	125	73	86
2	97	86	98
3	86	94	98
4	100	92	98
5	110	80	90
6	122	78	91
7	109	87	97
8	93	93	98
9	95	91	98
10	193	69	76
PRINCE EDWARD ISLAND	132	80	91
Kings	137	84	98
Prince	129	80	93
Queens	141	77	85
NOVA SCOTIA	155	54	68
Annapolis	156	63	86
Antigonish	157	60	52
Cape Breton	143	48	62
Colchester	183	59	80
Cumberland	154	68	91
Digby	136	64	81
Guysborough	130	61	85
Halifax	191	42	53
Hants	159	62	79
Inverness	165	60	78
Kings	181	47	65
Lunenburg	137	65	87
Pictou	148	67	85
Queens	145	65	85
Richmond	164	56	75
Shelburne	125	68	94
Victoria	139	60	80
Yarmouth	147	67	84
NEW BRUNSWICK	150	65	80
Albert	159	79	94
Carleton	140	68	88
Charlotte	154	72	91
Gloucester	110	70	84
Kent	102	69	80
Kings	148	80	92
Madawaska	148	53	67
Northumberland	130	68	84
Queens	174	81	92
Restigouche	112	72	88
Saint John	193	54	70
Sunbury	204	61	74
Victoria	150	60	77
Westmorland	167	60	77
York	168	58	76
QUÉBEC	180	-	-
ONTARIO	208	75	95
MANITOBA	181	75	93
SASKATCHEWAN	209	35	45
ALBERTA	239	39	53
BRITISH COLUMBIA	218	36	55

Source: Provincial data were derived from the D.B.S. publications: Salaries and Qualifications of Teachers in Public Elementary and Secondary Schools, 1964-65; and Preliminary Statistics of Education 1965-66. Sub-Provincial data were prepared by Cheal, using, in the case of Newfoundland, a formula prepared by Kitchen for converting electoral district data into census division data.

TABLE A-12

Seven Measures of Educational Output in Canadian Provinces and Atlantic Subdivisions

Division	Retention (1)	Retention (2)	Completion (1)	Completion (2)	Retardation (1)	Retardation (2)	Retardation (3)
NEWFOUNDLAND	43	40	-	-	45	47	26
Division 1	63	76	41	59	23	24	13
2	39	62	20	29	27	32	16
3	26	41	14	27	23	31	14
4	35	54	24	28	33	36	18
5	43	57	29	40	29	27	13
6	63	66	44	44	30	27	13
7	52	73	29	39	23	28	12
8	31	51	19	30	25	30	14
9	37	57	32	34	27	33	16
10	30	31	26	19	29	34	21
PRINCE EDWARD ISLAND	38	43	28	29	40	40	22
Kings	61	39	-	-	26	23	12
Prince	54	33	-	-	19	20	9
Queens	27	33	-	-	20	16	7
NOVA SCOTIA	46	60	24	27	48	46	30
Annapolis	57	41	37	22	27	18	9
Antigonish	54	16	23	8	23	26	12
Cape Breton	58	34	27	18	22	22	14
Colchester	59	34	31	16	18	22	12
Cumberland	62	36	29	21	20	22	14
Digby	55	32	28	17	26	25	16
Guysborough	42	17	10	7	31	29	19
Halifax	59	34	31	20	25	23	14
Hants	57	38	24	12	28	30	17
Inverness	74	45	27	19	20	20	10
Kings	67	34	31	19	20	23	12
Lunenburg	50	33	25	20	27	29	14
Pictou	62	32	25	15	27	21	10
Queens	49	35	30	19	28	30	18
Richmond	60	33	29	22	24	30	14
Shelburne	47	27	12	10	25	24	12
Victoria	60	31	37	17	30	31	18
Yarmouth	46	35	19	18	25	24	12
NEW BRUNSWICK	50	57	29	36	41	41	26
Albert	37	33	31	30	17	15	9
Carleton	57	51	45	46	15	16	7
Charlotte	65	60	53	57	13	20	12
Gloucester	41	36	30	34	23	27	19
Kent	34	35	24	32	27	30	19
Kings	46	50	35	47	17	14	9
Madawaska	48	50	40	47	22	23	14
Northumberland	48	37	38	33	18	21	11
Queens	56	50	42	45	16	20	10
Restigouche	48	42	36	38	23	26	17
Saint John	67	62	58	55	18	21	10
Sunbury	41	41	33	37	22	17	11
Victoria	58	55	39	48	19	21	13
Westmorland	61	50	48	41	22	22	16
York	66	61	51	59	16	15	9
QUÉBEC	40	39	10	7	48	46	26
ONTARIO	52	62	48	54	30	33	13
MANITOBA	72	71	46	40	33	33	19
SASKATCHEWAN	74	81	64	62	27	26	13
ALBERTA	80	82	54	50	28	28	12
BRITISH COLUMBIA	78	79	64	62	34	30	11

NOTE: Reference should be made to the text for the meaning of these measures and for the sources of data.

TABLE A-13

Correlation Matrix for Twenty-Seven Variables:
New Brunswick Counties

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27
1	100	92	96	86	-59	-27	-36	-47	30	-59	-60	-46	-40	07	63	49	23	34	22	-28	58	-57	-57	48	45	-38	-20
2		100	88	97	-55	-33	-39	-51	32	-57	-60	-38	-39	00	61	47	21	32	39	-19	52	-55	-54	52	50	-42	-30
3			100	83	-61	-32	-42	-58	45	-63	-62	-47	-41	-03	72	54	37	47	24	-45	66	-62	-62	54	53	-42	-24
4				100	-59	-37	-43	-42	24	-58	-59	-35	-41	02	59	47	17	27	42	-14	49	-54	-52	52	45	-35	-24
5					100	74	83	-05	12	79	82	73	84	01	-65	-25	-20	-43	-42	18	-07	79	80	-58	-40	-25	-42
6						100	92	20	19	72	76	76	86	47	-69	-30	-57	-72	-77	42	12	78	85	-78	-62	-13	-23
7							100	18	-15	74	78	79	87	34	-69	-18	-43	-65	-67	32	16	80	84	-63	-62	-12	-21
8								100	-91	22	19	18	03	45	-53	-54	-69	-59	-31	70	-57	23	32	-48	-55	75	68
9									100	-23	-19	-20	-06	-54	58	51	81	69	28	-82	52	-25	-33	47	64	-61	-59
10										100	98	90	91	24	-92	-34	-43	-67	-57	45	-24	97	95	-68	-59	-20	-33
11											100	92	93	28	-90	-27	-43	-68	-62	41	-14	97	96	-66	-65	-22	-33
12												100	93	43	-83	-13	-46	-73	-60	48	05	90	93	-57	-64	-23	-35
13													100	33	-79	-14	-38	-65	-68	31	11	92	93	-62	-60	-35	-46
14														100	-44	17	-64	-77	-71	59	26	29	41	-22	-71	20	22
15															100	48	70	85	60	-71	39	-91	-93	75	78	-08	04
16																100	56	31	-03	-51	79	-31	-33	80	15	-29	-16
17																	100	90	42	-90	32	-46	-57	72	69	-22	-17
18																		100	66	-84	14	-71	-80	67	86	-12	-06
19																			100	-26	-23	-63	-68	48	74	-10	-09
20																				100	-45	47	56	-61	-62	30	20
21																					100	-17	-16	44	02	-44	-30
22																						100	97	-70	-68	-12	-23
23																							100	-75	-72	-08	-22
24																								100	53	-13	01
25																									100	-31	-31
26																										100	95
27																											100

1 Gr. XI, 1965, as % Gr. VII, 1961 (adjusted)
2 Gr. XII, 1965, as % Gr. VIII, 1961 (adjusted)
3 Pupils passing Gr. XI, 1965, as % Gr. VII, 1961 (adjusted)
4 Pupils passing Gr. XII, 1965, as % Gr. VIII, 1961 (adjusted)
5 % Gr. VIII pupils retarded 1 year or more, 1965
6 % Gr. VII pupils retarded 1 year or more, 1965
7 % Gr. VII boys retarded 2 years or more, 1965
8 % population rural non-farm, 1961
9 % population in towns of 10,000 or more
10 Children per family
11 Persons per household
12 % French-speaking only
13 % Roman Catholic
14 % born in province
15 % aged 20-64
16 % male work force in professions
17 Average male salaries and wages
18 % male wage earners regularly employed
19 Male labour force as % males 20-64
20 % male workers who are in primary industries
21 Female labour force as % females 20-64
22 % population illiterate
23 % population illiterate or functionally illiterate
24 % with some university education, or a degree
25 Per pupil expenditure on teachers' salaries, 1965.
26 % teachers with 2 years training or less
27 % elementary teachers with 2 years or less.

Decimal points are omitted.

TABLE A-14

Correlation Matrix for Twenty-Seven Variables:
Newfoundland Census Divisions

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27
1	100	85	88	89	-10	-76	-57	-59	61	-25	-15	-35	52	20	01	43	27	22	41	-44	35	-88	-77	44	09	-50	-18
2		100	61	84	-25	-66	-70	-26	42	-21	-20	-68	54	60	-39	03	-23	-22	29	-06	02	-73	-44	-04	-35	-09	28
3			100	76	14	-57	-29	-58	60	-01	13	-10	49	-06	13	63	47	33	27	-40	45	-70	-76	60	31	-63	-39
4				100	-31	-86	-71	-51	74	-28	-14	-55	74	39	-12	36	08	09	41	-32	33	-85	-69	27	-14	-33	-06
5					100	50	54	-39	05	85	69	35	-17	-28	-14	-06	50	42	25	-21	47	12	-26	43	23	-16	-15
6						100	82	50	-75	60	39	48	-72	-28	-13	-44	-13	-12	-42	39	-21	89	65	-27	05	37	17
7							100	20	-47	45	21	84	-58	-73	34	09	35	33	-48	-01	21	69	27	24	56	-20	-40
8								100	-82	-12	-15	00	-35	13	-17	-33	-73	-80	-78	85	-83	69	91	-81	-29	61	46
9									100	-08	03	-25	73	08	09	44	49	50	63	-62	66	-79	-85	58	10	-53	-37
10										100	88	06	-13	07	-52	-36	10	09	19	15	26	30	02	05	-17	23	22
11											100	-12	-06	17	-52	-28	08	04	34	21	13	20	00	02	-26	29	25
12												100	-43	-97	77	46	64	54	-46	-35	35	43	01	52	88	-53	-76
13													100	31	-13	41	08	-06	19	-12	30	-74	-59	17	-14	-23	-07
14														100	-87	-63	-75	-64	38	46	-42	-25	15	-65	-96	69	88
15															100	75	67	57	-31	-55	33	-01	-24	61	90	-74	-89
16																100	68	47	-23	-44	44	-42	-58	71	78	-87	-85
17																	100	91	24	-81	81	-30	-72	97	82	-84	-88
18																		100	41	-89	86	-25	-67	92	69	-76	-79
19																			100	-49	41	-54	-56	30	-29	-02	12
20																				100	-84	48	77	-85	-59	73	70
21																					100	-41	-80	86	51	-68	-66
22																						100	85	-45	-01	46	17
23																							100	-82	-37	74	54
24																								100	78	-90	-86
25																									100	-85	-95
26																										100	91
27																											100

1 Gr. XI, 1965, as % Gr. VII, 1961 (adjusted)
2 Gr. X, 1965, as % Gr. VI, 1961 (unadjusted)
3 Pupils passing Gr. XI, 1965, as % Gr. VII, 1961 (adjusted)
4 Pupils passing Gr. X, 1965, as % Gr. VI, 1961 (unadjusted)
5 % Gr. VIII pupils retarded 1 year or more, 1965
6 % Gr. VII pupils retarded 1 year or more, 1965
7 % Gr. VII boys retarded 2 years or more, 1965
8 % population rural non-farm, 1961
9 % population in towns of 10,000 or more
10 Children per family
11 Persons per household
12 % French-speaking only
13 % Roman Catholic
14 % born in province
15 % aged 20-64
16 % male work force in professions
17 Average male salaries and wages
18 % male wage earners regularly employed
19 Male labour force as % males 20-64
20 % male workers who are in primary industries
21 Female labour force as % of females 20-64
22 % population illiterate
23 % population illiterate or functionally illiterate
24 % with some university education or a degree
25 Per pupil expenditure on teachers' salaries, 1964-65.
26 % teachers with 2 years training or less
27 % elementary teachers with 2 years or less

Decimal points are omitted.

TABLE A-15

Correlation Matrix for Twenty-Seven Variables:
Nova Scotia Counties

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27
1	100	57	61	46	-58	-44	-39	-25	23	24	26	31	19	-41	-04	10	22	-03	13	05	22	-07	-18	18	60	-37	-29
2		100	56	76	-30	-39	-31	-07	10	-36	-30	30	-22	-27	36	-21	18	15	25	-14	-22	-26	-19	-20	36	-04	21
3			100	72	-21	-17	-10	-04	18	-12	-07	-01	-06	-49	29	13	35	16	30	-35	07	-21	-31	25	50	-32	-23
4				100	-28	-26	-24	-05	17	-39	-28	21	-07	-37	47	-10	29	17	20	-40	-20	-09	-05	-10	37	-21	04
5					100	57	58	47	-31	-17	-21	-20	-15	36	-04	-33	-30	-25	-24	10	-52	18	27	-29	-58	28	28
6						100	80	55	-42	09	10	-11	05	59	-16	-13	-28	-32	-52	13	-36	46	52	-26	-33	10	06
7							100	33	-16	-05	-03	-17	-10	34	04	-16	-16	-22	-55	13	-38	37	36	-26	-33	00	09
8								100	-85	-04	-12	29	00	53	-33	-57	-71	-58	-01	36	-61	42	57	-46	-38	34	42
9									100	-05	09	-30	-00	-54	42	39	75	57	-01	-39	44	-33	-46	26	35	-51	-40
10										100	97	31	83	24	-81	28	-10	-42	-18	44	38	60	36	27	06	-24	-57
11											100	29	85	17	-69	31	07	-30	-16	32	40	63	37	29	15	-41	-68
12												100	61	37	-41	-24	-44	-53	-14	30	-12	50	59	-31	00	09	03
13													100	28	-69	16	-14	-46	-26	27	25	72	56	09	04	-24	-51
14														100	-58	-45	-73	-71	-57	59	-46	53	73	-65	-67	58	43
15															100	18	56	73	25	-68	02	-64	-55	15	29	-23	07
16																100	61	54	10	-54	86	-25	-48	87	53	-35	-68
17																	100	84	30	-73	51	-36	-58	63	61	-71	-63
18																		100	40	-75	43	-67	-77	55	48	-46	-36
19																			100	-36	28	-41	-46	46	44	-26	-18
20																				100	-40	40	46	-53	-57	36	33
21																					100	-22	-47	81	66	-39	-67
22																						100	90	-30	-18	-11	-15
23																							100	-58	-40	15	16
24																								100	60	-48	-76
25																									100	-63	-57
26																										100	82
27																											100

1 Gr. XI, 1965, as % Gr. VII, 1961 (adjusted)
2 Gr. XII, 1965, as % Gr. VIII, 1961 (adjusted)
3 Pupils passing Gr. XI, 1965, as % Gr. VII, 1961 (adjusted)
4 Pupils passing Gr. XII, 1965, as % Gr. VIII, 1961 (adjusted)
5 % Gr. VIII pupils retarded 1 year or more, 1965
6 % Gr. VII pupils retarded 1 year or more, 1965
7 % Gr. VII boys retarded 2 years or more, 1965
8 % population rural non-farm, 1961
9 % population in towns of 10,000 or more
10 Children per family
11 Persons per household
12 % French-speaking only
13 % Roman Catholic
14 % born in province
15 % aged 20-64
16 % male work force in professions
17 Average male salaries and wages
18 % male wage earners regularly employed
19 Male labour force as % males 20-64
20 % male workers who are in primary industries
21 Female labour force as % females 20-64
22 % population illiterate
23 % population illiterate or functionally illiterate
24 % with some university education, or a degree
25 Per pupil expenditure on teachers' salaries, 1964-65
26 % teachers with 2 years training or less
27 % elementary teachers with 2 years or less

Decimal points are omitted.

TABLE A-16

Correlation Matrix for Twenty-Five Variables:

Prince Edward Island Counties

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	
1	100	66			55	97	90	98	-98	86	61	28	100	19	-98	-100	-74	-79	-66	88	-100	83	91	-100	100	92	98	1 Gr. XI, 1965, as % Gr. VII, 1961 (adjusted)
2		100			99	82	92	50	-50	19	-19	-53	63	87	-50	-63	-99	-98	-100	94	-59	13	28	-65	69	90	79	2 Gr. XII, 1965, as % Gr. VIII, 1961 (adjusted)
3																												
4																												
5					100	74	86	38	-38	06	-32	-64	52	92	-38	-52	-97	-95	-99	89	-47	00	15	-55	59	84	70	5 % Gr. VIII pupils retarded 1 year or more, 1965
6						100	98	90	-90	71	40	04	96	43	-90	-96	-88	-92	-82	97	-94	67	78	-97	98	99	100	6 % Gr. VII pupils retarded 1 year or more, 1965
7							100	80	-80	56	21	-16	88	60	-80	-88	-96	-98	-92	100	-85	51	63	-90	92	100	97	7 % Gr. VII boys retarded 2 years or more, 1965
8								100	-100	94	76	47	99	00	-100	-99	-60	-66	-50	77	-99	92	97	-98	97	82	92	8 % population rural non-farm, 1961
9									100	-94	-76	-47	-99	00	100	99	60	66	50	-77	99	-92	-97	98	-97	-82	-92	9 % population in towns of 10,000 or more
10										100	93	73	88	-33	-94	-88	-30	-38	-19	51	-91	100	100	-87	84	59	75	10 Children per family
11											100	93	64	-65	-76	-64	07	-01	19	16	-69	95	89	-62	58	25	45	11 Persons per household
12												100	32	-88	-47	-32	43	36	53	-21	-37	77	67	-29	25	-12	09	12 % French-speaking only
13													100	16	-99	-100	-71	-77	-63	86	-100	85	92	-100	100	90	97	13 % Roman Catholic
14														100	00	-16	-80	-75	-87	64	-10	-38	-24	-19	23	57	38	14 % born in province
15															100	99	60	66	50	-77	99	-92	-97	98	-97	-82	-92	15 % aged 20-64
16																100	71	77	63	-86	100	-85	-92	100	-100	-90	-97	16 % male work force in professions
17																	100	100	99	-97	67	-25	-39	74	-77	-95	-86	17 Average male salaries and wages
18																		100	98	-99	73	-32	-46	79	-82	-97	-90	18 % male wage earners regularly employed
19																			100	-94	59	-13	-28	65	-69	-90	-79	19 Male labour force as % males 20-64
20																				100	-83	46	59	-87	89	100	95	20 % male workers who are in primary industries
21																					100	-88	-94	100	-99	-88	-96	21 Female labour force as % females 20-64
22																						100	99	-84	81	54	71	22 % population illiterate
23																							100	-91	89	66	81	23 % population illiterate or functionally illiterate
24																								100	-100	-91	-98	24 % with some university education, or a degree
25																									100	93	99	25 Per pupil expenditure on teachers' salaries, 1964-65.
26																										100	98	26 % teachers with 2 years training or less
27																											100	27 % elementary teachers with 2 years or less

Decimal points are omitted.

TABLE A-17

Rank Order of Input Variables Significantly Related to Measures of Educational Output, among Prince Edward Island Counties

	Rank Order on Measures of				
	Retention		Retardation		
	(1)	(2)	(1)	(2)	(3)
Educational Deprivation					
1. % population illiterate					
2. % illiterate or functionally illiterate					
3. % with university education	3				
Proportion of Children in Population					
1. Children per family					
2. Persons per household					
3. % population aged 20-64					
Proportion of Population Urban					
1. % rural non-farm					
2. % in towns of 10,000					
Economic Variables					
1. % male work force in professions	3				
2. Average male salaries and wages		2	2		
3. % male wage earners regularly employed		3	3		
4. Male labour force as % of males 20-64		1	1		
5. Female labour force as % of females 20-64	3				
6. % male work force in primary industries		4	5		1.5
Additional Variables					
1. % population born in province			4		
2. % Roman Catholic	3				
3. % speaking only French					
Educational Variables					
1. Per pupil expenditure on teachers' salaries	3				
2. % teachers with 2 years training or less		5	6		1.5
3. % elementary teachers with 2 years or less				1	

Source: Table A-16.

TABLE A-18

Correlation Matrix for Twenty-Five Variables: Counties and Census Divisions of the Atlantic Provinces

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	
1	100		47		-31	-37	-31	-26	23	-44	-45	-16	-13	-13	40	17	11	22	39	-23	42	-64	-61	31	53	-56	-36	1 Gr. XI, 1965, as % Gr. VII, 1961 (adjusted)
2																												
3			100		-37	-25	-06	-16	32	-10	-09	12	02	-23	21	41	38	29	00	-45	17	-05	-14	31	40	-33	-25	3 Pupils passing Gr. XI, 1965, as % Gr. VII, 1961 (adjusted)
4																												
5					100	76	66	20	-15	37	38	-02	27	29	-25	-20	-06	-23	-34	09	-30	25	36	-36	-35	15	11	5 % Gr. VIII pupils retarded 1 year or more, 1965
6						100	82	42	-36	51	54	07	31	50	-36	-16	-22	-44	-68	24	-40	54	67	-52	-44	29	16	6 % Gr. VII pupils retarded 1 year or more, 1965
7							100	32	-22	44	44	34	17	23	-23	-08	-07	-29	-59	10	-21	49	53	-37	-24	01	-02	7 % Gr. VIII boys retarded 2 years or more, 1965
8								100	-83	04	02	05	-08	36	-31	-44	-63	-58	-34	49	-60	21	38	-51	-27	28	35	8 % population rural non-farm, 1961
9									100	-12	-06	-06	16	-39	35	47	65	58	21	-59	47	-22	-32	41	33	-37	-40	9 % population in towns of 10,000 or more
10										100	97	47	61	31	-81	-05	-07	-44	-48	33	-26	82	77	-32	-50	37	08	10 Children per family
11											100	43	67	35	-77	01	-03	-44	-53	29	-29	84	82	-34	-55	40	10	11 Persons per household
12												100	18	09	-41	-04	-16	-33	-08	19	11	42	38	-16	-17	-16	-19	12 % French-speaking only
13													100	41	-52	14	-00	-36	-42	13	-16	41	48	-25	-46	30	11	13 % Roman Catholic
14														100	-55	-11	-59	-70	-40	52	-25	24	45	-49	-76	46	44	14 % born in province
15															100	31	46	68	34	-55	41	-63	-68	48	69	-53	-36	15 % aged 20-64
16																100	59	39	-13	-51	55	-07	-16	70	26	-23	-39	16 % male work force in professions
17																	100	84	12	-80	39	-11	-31	63	53	-34	-41	17 Average male salaries and wages
18																		100	45	-82	47	-45	-63	68	67	-46	-42	18 % male wage earners regularly employed
19																			100	-23	46	-66	-74	47	41	-40	-27	19 Male labour force as % males 20-64
20																				100	-45	31	42	-59	-56	45	42	20 % male workers who are in primary industries
21																					100	-46	-59	71	43	-55	-56	21 Female labour force as % of females 20-64
22																						100	94	-47	-53	55	32	22 % population illiterate
23																							100	-63	-64	58	37	23 % population illiterate or functionally illiterate
24																								100	58	-51	-62	24 % with some university education or a degree
25																									100	-71	-62	25 Per pupil expenditure on teachers' salaries, 1964-65.
26																										100	95	26 % teachers with 2 years training or less
27																											100	27 % elementary teachers with 2 years or less

Decimal points are omitted.

TABLE A-19

Correlation Matrix for Twenty-Seven Variables:
Provinces of Canada

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27
1	100	95	86	77	-80	-88	-79	-51	30	-71	-74	-41	-71	-88	56	40	65	53	35	14	49	-07	-35	72	79	-22	-10
2		100	92	88	-81	-89	-76	-46	26	-79	-82	-50	-75	-86	59	34	61	60	47	15	54	-25	-53	72	81	-17	-04
3			100	98	-88	-96	-88	-56	26	-88	-91	-46	-68	-88	66	34	60	58	65	19	68	-40	-68	75	82	-13	-01
4				100	-86	-91	-84	-47	23	-86	-87	-48	-67	-83	62	32	56	56	62	15	65	-43	-70	70	77	-06	07
5					100	97	92	56	-16	72	70	50	68	74	-54	-32	-55	-46	-57	-33	-60	14	43	-53	-75	-06	-15
6						100	94	60	-20	79	81	45	67	84	-60	-34	-59	-51	-61	-31	-63	21	51	-65	-82	11	01
7							100	65	-33	76	76	39	62	86	-65	-51	-69	-51	-48	-14	-59	25	49	-70	-82	12	02
8								100	-72	76	74	-22	07	65	-89	-74	-80	-83	-58	16	-82	53	56	-72	-83	49	43
9									100	-60	-51	29	-01	-58	85	93	88	86	05	-78	61	-56	-43	74	61	-39	-30
10										100	98	29	54	87	-91	-55	-77	-84	-68	12	-87	72	85	-86	-84	19	06
11											100	24	49	88	-86	-48	-71	-78	-73	01	-82	68	84	-86	-86	32	20
12												100	92	33	04	28	01	08	-15	-34	-05	03	23	-10	-06	-66	-73
13													100	63	-26	-04	-34	-23	-19	-19	-25	11	33	-41	-38	-42	-52
14														100	-79	-63	-82	-71	-41	17	-68	44	64	-94	-88	26	12
15															100	81	92	95	49	-40	83	-71	-71	86	84	-39	-28
16																100	93	81	-02	-68	52	-38	-31	73	72	-47	-38
17																	100	89	18	-51	64	-45	-47	85	85	-39	-27
18																		100	42	-45	79	-68	-66	80	83	-41	-29
19																			100	44	76	-60	-77	40	52	-11	-08
20																				100	-15	34	10	-38	-09	15	09
21																					100	-71	-81	74	72	-12	-03
22																						100	92	-61	-45	16	08
23																							100	-72	-62	13	03
24																								100	86	-40	-26
25																									100	-51	-40
26																										100	99
27																											100

Decimal points are omitted.

1 % age 7 boys, 1952-53 reaching Gr. XI by 1964-65
2 % age 7 girls, 1952-53 reaching Gr. XI by 1964-65
3 % age 7 boys, 1952-53 reaching Gr. XII
4 % age 7 girls, 1952-53 reaching Gr. XII
5 % Gr. VIII pupils retarded 1 year or more, 1965
6 % Gr. VII pupils retarded 1 year or more, 1965
7 % Gr. VII boys retarded 2 years or more, 1965
8 % population rural non-farm, 1961
9 % population in towns of 10,000 or more
10 Children per family
11 Persons per household
12 % French-speaking only
13 % Roman Catholic
14 % born in province
15 % aged 20-64
16 % male work force in professions
17 Average male salaries and wages
18 % male wage earners regularly employed
19 male labour force as % males 20-64
20 % male workers who are in primary industries
21 Female labour force as % of females 20-64
22 % population illiterate
23 % population illiterate or functionally illiterate
24 % with some university education or a degree
25 Per pupil expenditure on teachers' salaries, 1965
26 % teachers with 2 years training or less
27 % elementary teachers with 2 years or less

PROFILES OF EDUCATION
in the
ATLANTIC PROVINCES

APPENDIX B

APPENDIX B

TABLES

B-1 Per Cent Distribution of Teachers by Teaching Level and Community Size, Atlantic Provinces, 1966-67

2 Distribution of Teachers, Atlantic Provinces, 1966-67

3 Basic Teaching Certificates in Canada

4 Average Salaries, Beginning Elementary Teachers, 1960-61

5 Average Salaries, Beginning Elementary Teachers, 1966-67

6 Average Salaries, Elementary Teachers 4-9 Years Experience, 1960-61

7 Average Salaries, Elementary Teachers 4-9 Years Experience, 1966-67

8 Dollar and Per Cent Increases in Average Salaries, 1961-67

9 Average Salaries, Beginning Secondary Teachers, 1960-61

10 Average Salaries, Beginning Secondary Teachers, 1966-67

11 Average Salaries, Secondary Teachers With 4-9 Years Experience, 1960-61

12 Average Salaries, Secondary Teachers With 4-9 Years Experience, 1966-67

TABLES, cont'd

B-13 Dollar and Per Cent Increases in Average Salaries, Beginning Secondary Teachers, 1961-67

14 Dollar and Per Cent Increases in Average Salaries, Secondary Teachers 4-9 Years Experience, 1961-67

15 Newfoundland Interim Salary Scale (Dollars), 1967-68

16 New Brunswick Memorandum of Agreement

17 Salary Scale (A) County of Leduc No. 25 (Alberta), (B) Calgary Roman Catholic Separate School District No. 1

18 Salary Scale (A) Medicine Hat School District No 76, (B) County of Newell No. 4

TABLE B-1

Per Cent Distribution of Teachers by Teaching Level and Community Size, Atlantic Provinces, 1966-67

Community Size	All Teachers			Elem.	Elem.-Sec.	Sec.
	M	F	T	T	T	T
Nfld.						
Rural*	52.5	43.2	46.5	35.2	62.1	34.7
1,000 - 9,999	29.7	32.7	31.6	38.7	23.4	36.3
10,000 +	17.8	24.1	21.9	26.1	14.5	29.0
Total	100.0	100.0	100.0	100.0	100.0	100.0
P.E.I.						
Rural*	41.6	65.2	60.3	65.3	36.8	48.9
1,000 - 9,999	32.7	21.7	24.0	20.6	13.2	34.8
10,000 +	25.7	13.1	15.7	14.1	50.0	16.3
Total	100.0	100.0	100.0	100.0	100.0	100.0
N.S.						
Rural*	38.4	41.7	40.9	42.6	42.3	33.7
1,000 - 9,999	27.3	23.9	24.7	23.3	28.2	27.4
10,000 +	34.3	34.4	34.4	34.1	29.5	38.9
Total	100.0	100.0	100.0	100.0	100.0	100.0
N.B.						
Rural*	37.9	47.6	45.1	50.1	42.0	35.9
1,000 - 9,999	28.7	27.7	28.0	26.1	28.2	31.5
10,000 +	33.5	24.6	26.9	23.8	29.8	32.6
Total	100.0	100.0	100.0	100.0	100.0	100.0
Atlantic						
Rural*	43.1	48.5	44.9	44.8	47.2	35.9
1,000 - 9,999	28.8	22.2	27.5	27.6	26.7	31.3
10,000 +	28.1	23.3	27.6	27.6	26.0	32.8
Total	100.0	100.0	100.0	100.0	100.0	100.0

* Less than 1,000

Source: D.B.S. unpublished data.

TABLE B-2

Distribution of Teachers, Atlantic Provinces, 1966-67

Province		All Schools			Elementary			Elem.-Sec.			Secondary		
		M	F	T	M	F	T	M	F	T	M	F	T
					All rural schools								
Nfld.	no.	1,043	1,582	2,625	524	1,387	1,911	297	108	405	222	87	309
	%	39.7	60.3	100.0	27.4	72.6	100.0	73.3	26.7	100.0	71.8	28.2	100.0
P.E.I.	no.	113	682	795	36	584	620	4	9	13	73	89	162
	%	14.2	85.8	100.0	5.8	94.2	100.0	30.7	69.2	100.0	45.1	54.9	100.0
N.S.	no.	740	2,006	2,746	241	2,083	2,324	242	222	464	257	241	498
	%	26.9	73.1	100.0	10.4	89.6	100.0	52.2	47.8	100.0	51.6	48.4	100.0
N.B.	no.	659	2,469	3,128	242	2,083	2,325	165	147	312	252	239	491
	%	21.1	78.9	100.0	10.4	89.6	100.0	52.9	47.1	100.0	51.3	48.7	100.0
					Centres of 1,000 - 9,999								
Nfld.	no.	590	1,195	1,785	262	1,047	1,309	108	45	153	220	103	323
	%	33.1	66.9	100.0	20.0	80.0	100.0	70.6	29.4	100.0	68.1	31.9	100.0
P.E.I.	no.	189	227	316	28	168	196	3	2	5	58	57	115
	%	28.2	71.8	100.0	14.3	85.7	100.0	60.0	40.0	100.0	50.4	49.6	100.0
N.S.	no.	526	1,460	1,986	140	1,132	1,272	161	149	310	225	179	404
	%	26.5	73.5	100.0	11.0	89.0	100.0	51.9	48.1	100.0	55.7	44.3	100.0
N.B.	no.	449	1,439	1,938	116	1,095	1,211	110	199	309	273	245	518
	%	25.7	74.3	100.0	9.6	90.4	100.0	35.6	64.4	100.0	52.7	47.3	100.0
					Centres of 10,000 - 999,999								
Nfld.	no.	353	881	1,234	150	731	881	53	42	95	150	108	258
	%	28.6	71.4	100.0	17.0	83.0	100.0	55.8	44.2	100.0	58.1	41.9	100.0
P.E.I.	no.	170	137	207	25	109	134	10	9	19	35	19	54
	%	33.8	66.2	100.0	18.7	81.3	100.0	52.6	47.4	100.0	64.8	35.2	100.0
N.S.	no.	660	2,101	2,761	201	1,661	1,862	164	160	324	295	280	575
	%	23.9	76.1	100.0	10.8	89.2	100.0	50.6	49.4	100.0	51.3	48.7	100.0
N.B.	no.	583	1,278	1,861	122	982	1,104	131	90	221	330	206	536
	%	31.3	68.7	100.0	11.1	88.9	100.0	59.3	40.7	100.0	61.6	38.4	100.0

Source: Derived from D.B.S. unpublished data.

<u>Basic Teaching Certificates in Canada</u>

The following chart lists the basic teaching certificates currently issued in Canada according to the approximate minimum years of training required above Junior Matriculation. The data are based on an analysis of regulations obtained from the provincial departments of education. Only those certificates conveying general teaching authority are recorded. Certificates to the left of the heavy line cannot be made permanent.

Basic Certificates Offered in Canada by Approximate Minimum
Years of Training Above Junior Matriculation

Province	Approximate Minimum Years of Training Above Junior Matriculation							
	1	2	3	4	5	6	7	8
Nfld.	Grade 1 A Licence	Grade 2	Grade 3	Grade 4	Grade 5	Grade 6	Grade 7	Grade 8
P.E.I.	Cert. A	Cert. I	Cert. II	Cert. III	Cert. IV	Cert. V		
N.S.			Teacher's Licence Class I	Prof. Cert. Class III	Prof. Cert. Class II	Prof. Cert. Class I		Prof. Cert. Class IA
N.B.	Teacher's Licence	Cert. I Cert. II	Cert. III	Letter of Standing IV	Cert. V	Cert. V	Cert. VI	
Man.		First Class			Collegiate			
Sask.		Interim Standard	Standard A		Prof. A			
Alta.			Standard Elementary ---- Standard Secondary	Prof.				
B.C.	Elementary C	Elementary B	Elementary A	Prof. C	Prof. B	Prof. A		

Cert. = Certificate

Prof. = Professional

<u>Source</u>: Research Division, Canadian Teachers' Federation, Ottawa.

TABLE B-4

Average Salaries, Beginning Elementary Teachers, 1960-61

(Dollars)

Province or Region	Level 1				Level 2-3				Level 4-7			
	U*	R‡	T	U-R	U	R	T	U-R	U	R	T	U-R
Nfld.	2,368	2,426	2,393	-58	2,823	2,872	2,837	-49	3,655	-	3,655	-
P.E.I.	2,053	1,975	1,986	+78	2,506	2,413	2,495	+93	-	-	-	-
N.S.	1,881	1,760	1,812	+121	2,310	2,118	2,237	+192	3,696	3,427	3,648	+269
N.B.	2,073	1,974	1,944	+99	2,348	2,093	2,263	+255	4,074	3,380	3,948	+694
Atlantic	2,094	2,009	2,044	+85	2,497	2,374	2,453	+123	3,808	3,404	3,753	+404
Man.	2,885	2,626	2,662	+259	3,071	2,866	2,962	+205	4,233	2,750	3,862	+1,483
Sask.	-	2,542	2,542	-	2,917	2,765	2,815	+152	4,388	2,700	3,739	+1,688
Alta.	-	-	-	-	3,047	3,071	3,058	-24	4,286	3,998	4,236	+288
B.C.	3,012	3,065	3,033	-53	3,594	3,538	3,576	+56	4,530	4,524	4,530	+06
Western	2,948	2,744	2,746	+204	3,157	3,060	3,103	+97	4,359	3,493	4,092	+866
Differences												
W-A	+854	+735	+702		+660	+686	+650		+551	+89	+339	
%	40.8	36.6	34.3		26.4	29.0	26.5		14.5	2.6	9.0	

*U = Urban ‡R = Rural

Source: Derived from D.B.S. Salaries and Qualifications of Teachers 1960-61, 1964-65, p. 36 - 37.

TABLE B-5

Average Salaries, Beginning Elementary Teachers, 1966-67

(Dollars)

Province or Region	Level 1				Level 2-3				Level 4-7			
	U*	R‡	T	U-R	U	R	T	U-R	U	R	T	U-R
Nfld.	2,663	2,680	2,670	-17	3,169	3,472	3,258	-303	4,271	4,811	4,364	-540
P.E.I.	3,000	2,621	2,675	+379	3,431	2,993	3,139	+438	4,163	3,350	4,000	+813
N.S.	2,280	2,380	2,335	-100	3,339	3,165	3,261	+174	4,936	4,730	4,893	+206
N.B.	2,977	2,413	2,789	+564	3,179	3,007	3,106	+172	4,534	4,166	4,425	+368
Atlantic	2,681	2,644	2,664	+37	3,246	3,083	3,174	+163	4,725	4,514	4,678	+211
Man.	3,411	3,349	3,380	+62	3,489	3,284	3,410	+205	5,262	-	5,262	-
Sask.	-	-	-	-	3,803	3,517	3,659	+286	5,776	5,875	5,786	-99
Alta.	-	-	-	-	4,791	4,194	4,572	+597	5,385	5,091	5,367	+294
B.C.	3,613	3,647	3,631	-34	4,379	4,294	4,349	+85	5,232	5,282	5,247	-50
Western	3,465	3,445	3,455	+20	4,064	3,751	3,970	+313	5,363	5,267	5,352	+96
Differences												
W-A	+784	+801	+791		+818	+668	+796		+638	+753	+674	
%	29.2	30.3	29.7		25.2	21.7	25.1		13.5	16.7	14.4	

*U = Urban ‡R = Rural

Source: Derived from D.B.S. unpublished data.

TABLE B-6

Average Salaries, Elementary Teachers 4-9 Years Experience, 1960-61

(Dollars)

Province or Region	Level 1				Level 2-3				Level 4-6			
	U*	R‡	T	U-R	U	R	T	U-R	U	R	T	U-R
Nfld.	2,947	2,959	2,951	-12	3,639	3,773	3,663	-134	4,382	4,570	4,410	-188
P.E.I.	2,695	2,324	2,434	+371	3,017	2,756	2,959	+261	3,592	-	3,432	-
N.S.	2,511	2,365	2,429	+146	3,106	2,818	2,985	+288	4,468	4,054	4,381	+414
N.B.	2,727	2,279	2,509	+448	2,963	2,602	2,833	+361	4,163	3,668	3,982	+495
Atlantic	2,720	2,482	2,581	+238	3,181	2,987	3,110	+194	4,151	4,097	4,051	+54
Man.	3,716	3,067	3,192	+649	3,844	3,333	3,677	+511	5,493	3,167	5,387	+2,326
Sask.	3,310	2,969	3,048	+341	3,967	3,868	3,904	+99	5,305	4,430	5,137	+875
Alta.	4,019	4,152	4,101	-133	4,243	4,241	4,242	+2	5,409	5,660	5,447	-251
B.C.	3,706	3,784	3,744	-78	4,690	4,654	4,681	+36	5,889	6,257	5,920	-368
Western	3,688	3,493	3,521	+195	4,186	4,024	4,126	+162	5,524	4,881	5,473	+643
Differences W-A	+968	+1,011	+940		+1,005	+1,037	+1,016		+1,373	+784	+1,422	
%	35.6	40.7	36.4		31.6	34.7	32.7		33.1	19.1	35.1	

*U = Urban ‡R = Rural

Source: Derived from D.B.S. Salaries and Qualifications of Teachers, p. 40-4.

TABLE B-7

Average Salaries, Elementary Teachers 4-9 Years Experience, 1966-67

(Dollars)

Province or Region	Level 1				Level 2-3				Level 4-7			
	U*	R‡	T	U-R	U	R	T	U-R	U	R	T	U-R
Nfld.	3,540	3,596	3,557	-56	4,344	4,802	4,441	-458	5,509	6,324	5,725	-815
P.E.I.	3,509	3,084	3,176	+425	4,156	3,762	4,012	+394	5,406	4,525	5,308	+881
N.S.	3,124	3,058	3,092	+66	3,963	3,772	3,889	+191	6,145	5,865	6,079	+280
N.B.	3,248	2,969	3,109	+279	4,087	3,792	3,947	+295	5,997	5,318	5,784	+679
Atlantic	3,394	3,179	3,297	+215	4,053	3,804	3,963	+249	6,010	5,814	5,962	+196
Man.	4,749	3,946	4,269	+803	4,622	4,066	4,465	+556	7,017	6,058	6,933	+959
Sask.	4,300	3,557	3,650	+743	4,976	4,851	4,915	+125	7,422	6,418	7,311	+1,004
Alta.	4,799	4,895	4,848	-96	5,015	5,225	5,076	-210	6,832	7,370	6,896	-538
B.C.	3,960	4,218	4,108	-258	5,651	5,553	5,622	+98	6,889	6,751	6,865	+138
Western	4,372	4,165	4,271	+207	5,130	4,996	5,085	+134	6,922	6,878	6,917	+44
Differences W-A	+978	+986	+974		+1,077	+1,192	+1,122		+912	+1,064	+955	
%	28.8	31.0	29.5		26.6	31.3	28.3		15.2	18.3	16.0	

*U = Urban ‡R = Rural

Source: Derived from D.B.S. unpublished data.

TABLE B-8

Dollar and Per Cent Increases in Average Salaries, 1961-67

A. Beginning Elementary Teachers

Province or Region	Level 1				Level 2-3				Level 4-6			
	U*	R‡	Total		U	R	Total		U	R	Total	
	%	%	%	$	%	%	%	$	%	%	%	$
Nfld.	12.5	10.5	11.6	277	12.3	20.9	14.8	421	16.9	-	19.4	709
P.E.I.	46.1	32.7	34.7	689	36.9	24.0	25.8	644	-	-	-	-
N.S.	21.1	35.2	28.9	523	44.5	49.4	45.8	1024	33.5	38.0	34.1	1245
N.B.	43.6	22.2	43.5	845	35.4	43.7	37.3	843	11.3	23.3	12.1	477
Atlantic	28.0	31.6	30.3	620	30.0	29.9	29.4	721	24.1	32.6	24.6	925
Man.	18.2	28.7	27.0	718	13.6	14.6	15.1	448	24.3	-	36.3	1400
Sask.	-	-	-	-	30.4	27.2	30.0	844	31.6	117.6	54.7	2047
Alta.	-	-	-	-	57.2	36.6	49.5	1514	25.5	27.3	26.7	1131
B.C.	20.0	18.5	19.7	598	21.8	21.4	21.6	773	15.6	16.8	15.8	717
Western	17.5	25.9	25.8	709	28.7	22.6	27.9	867	23.0	50.8	30.8	1260

B. Elementary Teachers 4-9 Years Experience

	Level 1				Level 2-3				Level 4-6			
	U	R	Total		U	R	Total		U	R	Total	
	%	%	%	$	%	%	%	$	%	%	%	$
Nfld.	20.1	21.5	20.5	606	19.4	27.3	21.2	778	25.7	38.4	29.8	1315
P.E.I.	30.2	32.7	30.5	742	37.8	36.5	35.6	1053	50.5	-	54.7	1876
N.S.	24.4	29.3	27.3	663	27.6	33.9	30.3	904	37.5	44.7	38.8	1698
N.B.	19.1	30.3	23.9	600	37.9	45.7	39.3	1114	44.1	45.0	45.3	1802
Atlantic	24.8	28.1	27.7	716	27.4	27.4	27.4	853	44.8	41.9	47.2	1911
Man.	27.8	28.7	33.7	1077	20.2	22.0	21.4	788	27.7	91.3	28.7	1546
Sask.	29.9	19.8	19.8	602	25.4	25.4	25.9	1011	39.9	44.9	42.3	2174
Alta.	19.4	17.9	18.2	747	18.2	23.2	19.7	834	26.4	30.2	26.6	1449
B.C.	6.9	11.5	9.7	364	20.5	19.3	20.1	941	17.0	7.9	16.0	945
Western	18.5	19.2	21.3	750	22.6	24.2	23.2	959	25.3	40.9	26.4	1444

*U = Urban ‡R = Rural

Source: Tables B-4 through B-7.

TABLE B-9

Average Salaries, Beginning Secondary Teachers, 1960-61

(Dollars)

Province or Region	Levels 2-3				Levels 4-6				All Levels
	U*	R‡	T	U-R	U	R	T	U-R	T
Nfld.	3,072	-	3,072	-	3,782	3,680	3,766	+102	2,961
P.E.I.	-	3,525	3,720	-	3,550	-	3,480	-	3,261
N.S.	2,331	2,143	2,253	+188	3,713	3,391	3,574	+322	3,059
N.B.	2,952	2,799	2,842	+153	3,882	3,606	3,787	+276	3,066
Atlantic	2,785	2,822	2,972	-37	3,758	3,559	3,652	+199	3,087
Man.	3,267	3,833	3,380	-566	4,342	4,175	4,329	+167	3,990
Sask.	3,428	3,142	3,235	+286	4,628	4,266	4,530	+362	3,930
Alta.	3,890	3,691	3,824	+199	4,537	4,502	4,530	+35	4,082
B.C.	4,136	4,051	4,104	+85	4,761	4,665	4,750	+96	4,420
Western	3,680	3,679	3,636	+1	4,567	4,407	4,535	+160	3,856
W-A	+895	+857	+664		+809	+848	+883		+769
W-A as % of A	32.1	30.4	22.3		21.5	23.8	24.2		24.9

*U = Urban ‡R = Rural

Source: Derived from D.B.S. Salaries and Qualifications 1960-61, p. 36-37

TABLE B-10

Average Salaries, Beginning Secondary Teachers, 1966-67

(Dollars)

Province or Region	Levels 2-3				Levels 4-7				All Levels
	U*	R‡	T	U-R	U	R	T	U-R	T
Nfld.	3,267	3,226	3,248	+41	4,451	4,819	4,550	-368	3,478
P.E.I.	3,300	3,500	3,407	-200	4,064	4,186	4,132	-122	3,814
N.S.	3,510	3,442	3,476	+68	4,888	4,770	4,846	+118	4,205
N.B.	3,590	3,486	3,536	+104	4,867	4,625	4,788	+242	4,135
Atlantic	3,499	3,442	3,470	+57	4,776	4,655	4,733	+121	4,036
Man.	4,372	4,454	4,398	-82	5,376	5,500	5,380	-124	4,823
Sask.	4,263	4,051	4,134	+212	5,936	5,680	5,843	+256	5,151
Alta.	3,881	4,470	4,003	-589	4,990	5,415	5,105	-425	4,434
B.C.	5,055	4,903	5,018	+152	5,597	5,606	5,578	-9	5,435
Western	4,099	4,407	4,181	-308	5,440	5,552	5,465	-112	4,886
W-A	+600	+965	+711		+664	+897	+732		+850
W-A as % of A	17.1	28.0	20.5		13.9	19.3	15.5		21.1

*U = Urban ‡R = Rural

Source: Derived from D.B.S. unpublished data.

TABLE B-11

Average Salaries, Secondary Teachers With 4-9 Years Experience, 1960-61

(Dollars)

Province or Region	Levels 2-3				Levels 4-6				All Levels
	U*	R‡	T	U-R	U	R	T	U-R	T
Nfld.	3,636	3,323	3,589	+313	4,403	4,488	4,421	-85	3,718
P.E.I.	3,385	2,875	3,181	+510	4,242	-	4,393	-	3,000
N.S.	3,179	3,001	3,081	+178	4,646	4,282	4,520	+364	4,067
N.B.	3,828	3,138	3,580	+690	4,972	4,405	4,853	+567	3,929
Atlantic	3,507	3,038	3,358	+469	4,566	4,392	4,547	+174	3,680
Man.	4,399	4,539	4,457	-140	5,866	5,251	5,807	+615	5,306
Sask.	4,676	4,437	4,533	+239	6,249	5,806	6,151	+443	5,373
Alta.	4,859	4,729	4,819	+130	6,127	6,234	6,144	-107	5,453
B.C.	5,094	5,060	5,085	+34	6,324	6,209	6,312	+115	6,052
Western	4,757	4,691	4,724	+66	6,142	5,875	6,104	+267	5,546
W-A	+1,250	+1,653	+1,366		+1,576	+1,483	+1,557		+1,866
W-A as % of A	35.6	54.4	40.7		34.5	33.8	34.2		50.7

*U = Urban ‡R = Rural

Source: D.B.S. Salaries and Qualifications of Teachers, 1960-61.

TABLE B-12

Average Salaries, Secondary Teachers With 4-9 Years Experience, 1966-67

(Dollars)

Province or Region	Levels 2-3				Levels 4-6				All Levels
	U*	R‡	T	U-R	U	R	T	U-R	T
Nfld.	4,478	4,519	4,488	-41	5,722	6,081	5,788	-359	4,932
P.E.I.	4,383	4,183	4,270	+200	6,193	5,747	6,012	+446	5,184
N.S.	4,308	4,051	4,164	+257	6,357	6,174	6,292	+183	5,707
N.B.	4,627	4,490	4,573	+137	6,562	5,860	6,422	+702	5,009
Atlantic	4,521	4,322	4,438	+199	6,273	6,075	6,217	+198	5,196
Man.	5,535	5,571	5,545	-36	7,279	7,221	7,270	+58	6,645
Sask.	5,782	5,215	5,420	+567	8,010	7,576	7,900	+434	6,935
Alta.	5,978	5,828	5,931	+150	7,281	7,598	7,321	-317	6,799
B.C.	6,248	6,089	6,212	+159	7,337	7,129	7,307	+208	7,063
Western	5,952	5,596	5,826	+356	7,395	7,356	7,389	+39	6,888
W-A	+1,431	+1,274	+1,388		+1,122	+1,281	+1,172		+1,692
W-A as % of A	31.7	29.5	31.3		17.9	21.1	18.9		32.6

*U = Urban ‡R = Rural

Source: Derived from D.B.S. unpublished data.

TABLE B-13

Dollar and Per Cent Increases in Average Salaries, Beginning Secondary Teachers, 1961-67

Province or Region	Levels 2-3				Levels 4-6			
	U*	R‡	Total		U	R	Total	
	%	%	%	$	%	%	%	$
Nfld.	6.3	-	5.7	176	17.7	31.0	20.8	784
P.E.I.	-	-0.7	-8.4	-313	14.5	-	18.7	652
N.S.	50.6	60.6	54.3	1,223	31.6	40.7	35.6	1,272
N.B.	21.6	24.5	24.4	694	25.4	28.3	26.4	1,001
Atlantic	25.6	22.0	16.8	498	27.1	30.8	29.6	1,081
Man.	33.8	16.2	30.1	1,018	23.8	31.7	24.3	1,051
Sask.	24.4	28.9	27.8	899	28.3	33.1	28.9	1,313
Alta.	-0.2	21.1	4.7	179	10.0	20.3	12.7	575
B.C.	22.2	21.0	22.3	914	17.6	20.2	17.4	828
Western	11.4	19.8	15.0	545	19.1	26.0	20.5	930

*U = Urban ‡R = Rural

Source: Tables B-9 and B-10.

TABLE B-14

Dollar and Per Cent Increases in Average Salaries, Secondary Teachers 4-9 Years Experience, 1961-67

Province or Region	Levels 2-3				Levels 4-6			
	U*	R‡	Total		U	R	Total	
	%	%	%	$	%	%	%	$
Nfld.	23.2	36.0	25.0	899	30.0	35.5	30.9	1,367
P.E.I.	29.5	45.5	34.2	1,089	46.0	-	36.9	1,619
N.S.	35.5	35.0	35.2	1,083	36.8	44.2	39.2	1,772
N.B.	20.9	43.1	27.7	993	32.0	33.0	32.3	1,569
Atlantic	28.9	42.3	32.2	1,080	37.4	38.3	36.7	1,670
Man.	25.8	22.7	24.4	1,088	24.1	37.5	25.2	1,463
Sask.	23.7	17.5	19.6	887	28.2	30.5	28.4	1,749
Alta.	23.0	23.2	23.1	1,112	18.8	21.9	19.2	1,177
B.C.	22.7	20.3	22.2	1,127	16.0	14.8	15.7	995
Western	25.1	19.3	23.3	1,102	20.4	25.2	21.1	1,285

*U = Urban ‡R = Rural

Source: Tables B-11 and B-12.

TABLE B-15

Newfoundland

Interim Salary Scale (Dollars), 1967-68

Certificate	1 yr.	2 yr.	3 yr.	4 yr.	5 yr.	6 yr.	7 yr.	8 yr.	9 yr.	10 yr.	11 yr.
I	3,312	3,496	3,680	3,864	3,956						
II	3,864	4,140	4,324	4,508	4,692	4,784					
III	4,508	4,784	4,960	5,244	5,428	5,612	5,704				
IV	5,244	5,520	5,796	6,072	6,256	6,440	6,624	6,716			
V	6,072	6,348	6,624	6,900	7,176	7,360	7,544	7,728	7,820		
VI	6,992	7,268	7,544	7,820	8,096	8,372	8,556	8,740	8,924	9,016	
VII	8,004	8,280	8,556	8,832	9,108	9,384	9,660	9,844	10,028	10,212	10,304

Source: Newfoundland Teachers Ass'n., May 26, 1967.

TABLE B-16

New Brunswick
Memorandum of Agreement

ARTICLE I- SALARY SCHEDULE

1.01 This schedule shall become effective January 1, 1967 and continue in effect until June 30, 1968.

1.02 Scale

TL	CI	CII	CIII	CIV	CV	CVI
2,800	3,200	3,600	4,200	5,200	4,700	6,300
3,000	3,400	3,875	4,475	5,524	6,050	6,700
3,200	3,600	4,150	4,750	5,850	6,400	7,100
3,400	3,800	4,425	5,025	6,175	6,750	7,500
3,600	4,000	4,700	5,300	6,500	7,100	7,900
3,800	4,200	4,975	5,575	6,825	7,450	8,300
4,000	4,400	5,250	5,850	7,150	7,800	8,700
			6,125	7,475	8,150	9,100
			6,400	7,800	8,500	9,500
				8,125	8,850	9,900
				8,450	9,200	10,300
6x200	6x200	6x275	8x275	10x325	10x350	10x400

1. L.S.IV with no teacher's licence - $500 less than CIV.

2. T.P. - minimum $2,200 - four $150 annual increments - Maximum $2,800.

3. 3rd Class - minimum $1,600 - four $150 annual increments - Maximum $2,200.

TABLE B-17

A. County of Leduc No. 25 (Alberta) Salary Scale

Years of Teaching Experience	Years of Teacher Education					
	One*	Two	Three	Four	Five	Six
0	3,900	4,500	5,200	6,300	6,700	7,100
1	4,110	4,755	5,490	6,660	7,060	7,460
2	4,320	5,010	5,780	7,020	7,420	7,820
3	4,530	5,265	6,070	7,380	7,780	8,180
4	4,740	5,520	6,360	7,740	8,140	8,540
5	4,950	5,775	6,650	8,100	8,500	8,900
6	5,160	6,030	6,940	8,460	8,860	9,260
7	5,370	6,285	7,230	8,820	9,220	9,620
8	5,580	6,540	7,520	9,180	9,580	9,980
9	5,790	6,795	7,810	9,540	9,940	10,340
10	6,000	7,050	8,100	9,900	10,300	10,700
11				10,150	10,550	11,000
12				10,400	10,800	11,300
	210x10	255x10	290x10	360x10 250x2	360x10 250x2	360x10 300x2

B. Calgary Roman Catholic Separate School District No. 1 Salary Scale

Years of Teaching Experience	Years of Teacher Education					
	A*	B	C	D	E	F
0	-	4,250	4,850	6,350	6,850	7,350
1	3,850	4,550	5,150	6,700	7,200	7,700
2	4,150	4,850	5,450	7,050	7,550	8,050
3	4,450	5,150	5,750	7,400	7,900	8,400
4	4,750	5,450	6,050	7,800	8,300	8,800
5	5,050	5,750	6,350	8,200	8,700	9,200
6	5,350	6,050	6,650	8,600	9,100	9,600
7	5,650	6,350	6,950	9,000	9,500	10,000
8	5,950	6,650	7,250	9,400	9,950	10,450
9	6,250	6,950	7,550	9,800	10,400	10,900
10				10,200	10,850	11,350
11				10,600	11,300	11,800

* One year of training beyond senior matriculation.

TABLE B-18

A. Medicine Hat School District No. 76 Salary Scale

Years of Teaching Experience	Years of Training					
	One*	Two	Three	Four	Five	Six
0	4,000	4,200	5,000	6,150	6,450	6,850
1	4,000	4,600	5,400	6,650	6,950	7,350
2	4,000	5,000	5,800	7,150	7,450	7,850
3	4,000	5,400	6,200	7,650	7,950	8,350
4	4,300	5,800	6,600	8,150	8,450	8,850
5	4,600	6,200	7,000	8,450	8,750	9,150
6	4,900	6,400	7,200	8,750	9,050	9,450
7	5,200	6,600	7,400	9,050	9,350	9,750
8	5,500	6,800	7,600	9,350	9,650	10,050
9	5,800	7,000	7,800	9,650	9,950	10,350
10	6,200	7,200	8,000	9,950	10,250	10,650
11				10,250	10,550	10,950
12				10,450	10,750	11,150

B. County of Newell No. 4 (Alberta) Salary Scale

Years of Teaching Experience	Years of Training					
	One*	Two	Three	Four	Five	Six
0	3,700	4,500	5,300	6,200	6,600	7,000
1	3,930	4,770	5,570	6,600	7,000	7,400
2	4,160	5,040	5,840	7,000	7,400	7,800
3	4,390	5,310	6,110	7,400	7,800	8,200
4	4,620	5,580	6,380	7,800	8,200	8,600
5	4,850	5,850	6,650	8,200	8,600	9,000
6	5,080	6,120	6,920	8,600	9,000	9,400
7	5,310	6,390	7,190	9,000	9,400	9,800
8	5,540	6,660	7,460	9,400	9,800	10,200
9	5,770	6,930	7,730	9,800	10,200	10,600
10	6,000	7,200	8,000	10,200	10,600	11,000

* One year of training beyond senior matriculation.

PROFILES OF EDUCATION
in the
ATLANTIC PROVINCES

APPENDIX C

APPENDIX C

TABLES

C-1 Full-Time Enrolment Beyond Senior Matriculation Year, Universities and Colleges, by Province, 1965-66 to 1967-68

2 Full-Time Enrolments in Universities and Colleges (Including Teachers' Colleges) in Canada and the Atlantic Provinces, 1950-51 to 1967-68

3 Full-Time Enrolment of Post-Secondary Students in Technician Diploma Courses at Technical Institutes, Canada and the Atlantic Provinces, 1951-52 to 1967-68

APPENDIX C

LIMITATIONS OF DATA AND ASSUMPTIONS UNDERLYING POST-SECONDARY ENROLMENT FORECASTS

Because we are basing enrolment forecasts on the 18-24 age group, given the much wider age-range of part-time and summer-time students, we must limit ourselves to full-time enrolments, winter session.

Interprovincial comparisons of university enrolment percentages have been made difficult by the fact that, while universities in some provinces admit students with junior matriculation standing, institutions in other provinces1/ admit only after senior matriculation. In Ontario some institutions admit students with junior matriculation standing while others admit students only after the senior matriculation year.

Another reason for difficulties in comparison is that in some provinces2/ all elementary- and secondary-teacher training is undertaken by the universities with courses either counting for credit toward a degree or requiring a university entrance standing for admission. In other provinces some students training to be elementary school teachers attend separately-established teacher-training institutions which have not necessarily the same entrance requirements as university faculties of education.

Still other reasons include an increasing number of students coming from outside Canada - nearly 13,000 in 1966-67 - and interprovincial migration of Canadian students, especially those taking professional and graduate courses who are attending universities outside their usual province of residence.

Table C-1

In an attempt to improve the comparability between provinces by eliminating university students in the year following junior matriculation from the calculations, Table C-1 relates total full-time enrolment above the senior matriculation level to the provincial population aged 18-24. About four-fifths of all full-time university-grade students are in this age group.

1/ Alberta, Saskatchewan and Manitoba (from 1964-65).

2/ British Columbia, Alberta, Saskatchewan, Manitoba (from 1965-66), Québec (in some cases), Prince Edward Island and Newfoundland.

TABLE C-1

Full-Time Enrolment Beyond Senior Matriculation Year, Universities and Colleges, by Province, 1965-66 to 1967-68

Academic Year and Province	(1) Total Full-Time Enrolment	(2) Enrolment in First Year Following Junior Matriculation*	(3) Enrolment Beyond Senior Matriculation (1)-(2)	(4) Population Aged 18-24‡	(5) (3) as % of (4)
	no.	no.	no.	000	%
1967-68					
Newfoundland	4,473	1,675	2,798	59.8	4.7
Prince Edward Island	1,369	587	782	11.7	6.7
Nova Scotia	10,501	1,747	8,754	84.9	10.3
New Brunswick	7,927	2,516	5,411	71.6	7.5
Québec:					
English-language institutions	23,623	5,860	17,763	n.a.	n.a.
French-language institutions	58,987	14,000#	44,987**	n.a.	n.a.
Total Québec	82,610	19,860#	62,750**	724.0	8.7**
Ontario	79,089	1,292	77,797	764.2	10.2
Manitoba	13,426	-	13,426	104.5	12.8
Saskatchewan	12,697	34	12,663	100.2	12.6
Alberta	19,688	131	19,557	158.0	12.4
British Columbia	29,427	9,637	19,790	206.6	9.6
Total Canada	261,207	37,479	223,728	2,290.2‡‡	9.8**
1966-67					
Newfoundland	3,893	1,649	2,244	55.7	4.0
Prince Edward Island	1,139	571	568	10.9	5.2
Nova Scotia	9,806	1,770	8,036	80.2	10.0
New Brunswick	6,862	2,194	4,668	66.4	7.0
Québec:					
English-language institutions	21,063	5,580	15,483	n.a.	n.a.
French-language institutions	54,007	9,718#	44,289**	n.a.	n.a.
Total Québec	75,070	15,298#	59,772**	691.0	8.7**
Ontario	68,589	1,402	67,187	711.3	9.4
Manitoba	12,389	-	12,389	99.9	12.4
Saskatchewan	11,577	69	11,508	94.6	12.2
Alberta	16,983	125	16,858	150.0	11.2
British Columbia	26,364	8,756	17,608	189.8	9.3
Total Canada	232,672	31,834	200,838	2,154.8‡‡	9.3**
1965-66					
Newfoundland	3,168	1,424	1,744	52.8	3.3
Prince Edward Island	924	463	461	10.0	4.6
Nova Scotia	9,457	2,261	7,196	79.5	9.1
New Brunswick	6,371	2,090	4,281	63.1	6.8
Québec:					
English-language institutions	18,966	5,286	13,680	n.a.	n.a.
French-language institutions	48,350	9,660#	38,690**	n.a.	n.a.
Total Québec	67,316	14,946#	52,370**	659.5	7.9**
Ontario	58,983	1,680	57,303	664.2	8.6
Manitoba	11,069	-	11,069	97.0	11.4
Saskatchewan	10,707	25	10,682	91.5	11.7
Alberta	14,749	96	14,653	143.7	10.2
British Columbia	23,144	7,709	15,435	173.5	8.9
Total Canada	205,888	30,694	175,194	2,039.5‡‡	8.6**

* This would be the equivalent of Grade 12 in Newfoundland, Nova Scotia, Québec, Manitoba, Saskatchewan, and Alberta, and Grade 13 in Ontario and British Columbia. The high schools in Prince Edward Island and New Brunswick do not offer courses beyond the junior matriculation year.

‡ Estimated as of June 1, 1965 for 1965-66, June 1, 1966 for 1966-67 and June 1, 1967 for 1967-68. The figures are the sum of estimates for individual years of age from 18 to 24 inclusive prepared by the Census Division, D.B.S.

\# The figure given for Québec is slightly low as some students who entered certain faculties of French-language universities after completing the equivalent of junior matriculation are not included.

** The figure given for Québec is slightly high as it includes some students who entered certain faculties of French-language universities in Québec after completing the equivalent of junior matriculation.

‡‡ The total for Canada includes the Yukon and the North West Territories.

Source: D.B.S. Survey of Higher Education Part I: Fall Enrolment in Universities and Colleges 1967-68.

Table C-1 shows that 43 per cent of the total enrolment in Prince Edward Island, 37 per cent in Newfoundland and 32 per cent in New Brunswick was in the equivalent of the senior matriculation year in 1967-68. The high schools in these provinces (with the exception of one or two in Newfoundland) teach only up to the end of the junior matriculation year. In contrast, in Nova Scotia, where many high schools give the senior matriculation year and where students may begin university after junior or senior matriculation,1/ only 17 per cent was in the equivalent of the senior matriculation year.

In 1967-68 the Prairie Provinces ranked highest when enrolment beyond the senior matriculation level was related to provincial population aged 18-24. Three of the four Atlantic Provinces (exclusive of Nova Scotia) ranked lowest. The percentages for Québec, and for Canada as a whole, are slightly high because some senior-matriculation-equivalent enrolment, as explained in a footnote, was included.

Table C-2

Table C-2 provides data by place of residence and place of enrolment for Canada and for each of the Atlantic Provinces. It also shows residents of each province attending university anywhere in Canada as a percentage of the province's 18-24 age group. Unlike Table C-1, it includes enrolments in teachers' colleges, and it has been assumed that the teachers' college enrolments in each province are identical to enrolments from that province. Data are not available for enrolments of Canadian students in foreign universities, but enrolments of foreign students in Canada are shown by province.

The inclusion of students in their senior matriculation year in Table C-2 has a relatively large effect on total enrolments of students from the Atlantic Provinces, especially in the case of students from Newfoundland, Prince Edward Island and New Brunswick. Between 1965-66 and 1966-67, while enrolments in Nova Scotia beyond the senior matriculation year advanced from 7,196 to 8,036, those of students in their senior matriculation year declined from 2,261 to 1,770, reflecting the decision of Dalhousie to demand senior matriculation for admission.

Our forecasts assume a continuation of the 1967-68 distribution of students in their senior matriculation year between school and university.

In Table C-2, the inclusion of teachers' colleges reflects the view that in Nova Scotia and New Brunswick, where separate teachers' colleges now exist, these institutions will

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1/ Except Dalhousie University, where senior matriculation is required.

TABLE C-2

Full-Time Enrolments in Universities and Colleges (Including Teachers' Colleges) in Canada and the Atlantic Provinces, 1950-51 to 1967-68

Province and Year	(1) Residents Enrolled in Province	(2) Residents Enrolled in Other Provinces	(3) Residents Enrolled in Canada (1) + (2)	(4) Canadian Non-Residents Enrolled	(5) Total Canadian Enrolment (1) + (4)	(6) Foreign Students Enrolled	(7) Total Full-Time Enrolment (5) + (6)	(8) Population Age 18-24	(9) (6) as % of (7)	(10) (3) as % of (5)	(11) (3) as of (8
	no.	no.	no.	no.	no.	no.	no.	no.	%	%	%
Newfoundland											
1950-51	380	382	762	-	380	-	380	42,300	-	200.5	1.8
1955-56	577	455	1,032	-	577	-	577	42,500	-	178.9	2.4
1960-61	1,400	505	1,905	-	1,400	-	1,400	45,100	-	136.1	4.2
1961-62	1,757	554	2,311	-	1,757	-	1,757	45,800	-	131.5	5.0
1962-63	1,983	549	2,532	-	1,983	15	1,998	47,800	0.8	126.7	5.3
1963-64	2,206	629	2,835	23	2,229	25	2,254	49,400	1.1	127.2	5.7
1964-65	2,582	607	3,189	34	2,616	36	2,652	50,900	1.4	121.9	6.3
1965-66	3,046	659	3,705	49	3,095	73	3,168	52,800	2.3	119.7	7.0
1966-67	3,776	637	4,413	62	3,838	55	3,893	55,700	1.4	115.0	7.9
1967-68	4,333	650	4,983	77	4,410	63	4,473	59,800	1.4	113.0	8.3
rince Edward Island											
1950-51	329	314	643	27	356	5	361	11,100	1.4	180.6	5.8
1955-56	259	275	534	54	313	8	321	9,400	2.5	170.6	5.7
1960-61	484	300	784	96	580	61	641	9,500	9.5	135.2	8.3
1961-62	644	330	974	91	735	63	798	9,500	7.9	132.5	10.3
1962-63	587	305	892	121	708	72	780	9,400	9.2	126.0	9.5
1963-64	543	345	888	169	712	76	788	9,700	9.6	124.7	9.2
1964-65	645	375	1,020	166	811	70	881	9,600	8.0	125.8	10.6
1965-66	745	369	1,114	128	873	51	924	10,000	5.5	127.6	11.1
1966-67	934	426	1,360	154	1,088	51	1,139	10,900	4.5	125.0	12.5
1967-68	1,122	446	1,568	169	1,291	78	1,369	11,700	5.7	121.5	13.4
Nova Scotia											
1950-51	2,812	594	3,406	1,235	4,047	237	4,284	69,700	5.5	84.2	4.
1955-56	3,102	663	3,765	1,303	4,405	368	4,773	69,200	7.7	85.5	5.
1960-61	4,155	894	5,049	1,570	5,725	588	6,313	72,400	9.3	88.2	7.
1961-62	4,190	942	5,132	1,769	5,959	875	6,834	72,900	12.8	86.1	7.
1962-63	4,495	923	5,418	2,030	6,525	940	7,465	75,600	12.6	83.0	7.
1963-64	5,061	962	6,023	2,324	7,385	962	8,347	76,900	11.5	81.6	7.
1964-65	5,676	987	6,663	2,364	8,040	1,043	9,083	79,300	11.5	82.9	8.
1965-66	6,427	1,055	7,482	2,568	8,995	1,017	10,012	79,500	10.2	83.2	9.
1966-67	7,007	1,125	8,132	2,518	9,525	859	10,384	80,200	8.3	85.4	10.
1967-68	7,663	1,256	8,919	2,599	10,262	894	11,156	84,900	8.0	86.9	10.
New Brunswick											
1950-51	1,476	971	2,447	694	2,170	78	2,248	56,100	3.5	112.8	4.
1955-56	1,774	834	2,608	992	2,766	169	2,935	53,900	5.8	94.3	4.
1960-61	2,476	891	3,367	1,882	4,358	223	4,581	55,800	4.9	77.3	6.
1961-62	2,791	958	3,749	2,084	4,875	265	5,140	56,400	5.2	76.9	6.
1962-63	3,159	1,032	4,191	2,035	4,194	295	5,489	58,400	5.4	80.7	7.
1963-64	3,812	1,122	4,934	2,037	5,849	305	6,154	59,600	5.0	84.4	8.
1964-65	4,384	1,160	5,544	2,139	6,523	321	6,844	61,000	4.7	85.0	9.
1965-66	5,073	1,242	6,315	2,028	7,101	351	7,452	63,100	4.7	88.9	10.
1966-67	5,514	1,343	6,857	2,077	7,591	385	7,976	66,400	4.8	90.3	10.
1967-68	6,323	1,441	7,764	2,301	8,624	444	9,068	71,600	4.9	90.0	10.
Canada											
1950-51	65,941	8,314	74,255			3,188	77,443	1,540,500	4.1		4
1955-56	71,243	7,927	79,170			4,385	83,555	1,564,500	5.3		5
1960-61	119,241	11,013	130,254			7,251	137,505	1,689,100	5.3		7
1961-62	132,661	12,351	145,012			7,900	152,912	1,712,600	5.2		8
1962-63	141,909	12,989	154,898			8,518	163,416	1,770,100	5.2		8
1963-64	162,914	14,267	177,181			9,490	186.671	1,848,800	5.1		9
1964-65	176,331	14,832	191,163			10,154	201,317	1,941,700	5.0		9
1965-66	198,435	15,911	214,346			11,284	225,630	2,039,500	5.0		10
1966-67	225,617	16,977	242,594			12,943	255,537	2,154,800	5.1		11
1967-68	250,755	18,485	269,240			15,356	284,596	2,290,200	5.4		11

Source: Calculated from: D.B.S. Survey of Higher Education, Part II, 1963-64 to 1967-68; Economic Council of Canada, Enrolment of Schools and Universities 1951-52 to 1975-76, Staff Study No. 20, 1967; Canada Year Book, 1954; data supplied by D.B.S. Census Division and D.B.S. Education Division.

be intregrated into the university system, with degree credit courses and university entrance requirements.

Table C-2 shows that in Newfoundland no foreign students were registered prior to 1962-63, and that since then they have averaged only 1.4 per cent of total enrolments, ranging between a high of 2.3 per cent and a low of 0.7 per cent. In Prince Edward Island numbers of foreign students throughout most of the 1950's were insignificant, but since 1960-61 they have ranged between 9.6 per cent and 4.5 per cent of total enrolments, with an average of 7.4 per cent. In Nova Scotia enrolments of foreign students rose from 5.5 per cent in 1950-51 to 9.3 per cent in 1960-61, since then ranging between 12.8 and 8.0 per cent, with an average of 10.4 per cent. Over this seven-year period the percentage declined almost continuously, with the highest percentage being in 1961-62 and the lowest in 1967-68. In New Brunswick the percentage of foreign students has ranged between 3.5 per cent and 5.8 per cent since 1950-51 and between 4.7 per cent and 5.4 per cent since 1960-61, with an average over the latter period of 5.0 per cent. The percentage of foreign students enrolled in Canada as a whole since 1950-51 has ranged between 4.1 per cent and 5.4 per cent, and since 1960-61 the range has been between 5.0 per cent and 5.4 per cent, with an average for this period of 5.2 per cent.

Future enrolments of foreign students depend very much on government and university policy. While the percentages for Newfoundland have been significantly below the corresponding Canadian percentages, Newfoundland's role as an educator of foreign students is a very new one. The percentages for Nova Scotia have been significantly above the Canadian percentages, but the gap between these percentages has been narrowing. It seems not unreasonable to assume that, by 1976-77, each of the Atlantic Provinces will have moved to a position where 5 per cent of its total enrolments are of foreign students. This percentage is assumed to hold in 1981-82 and again in 1986-87. The percentage of foreign students in 1971-72 is arrived at through interpolation between 1967-68 and 1976-77.

No students from other parts of Canada were enrolled in Newfoundland prior to 1963-64, and since then their numbers have been roughly the same as those of foreign students. Newfoundlanders enrolled elsewhere in Canada, on the other hand, were almost as numerous as Newfoundlanders enrolled in their own province until the late 1950's. While the absolute number of enrolments outside Newfoundland has since continued to increase to a peak in 1965-66, the ratio of enrolment of Newfoundlanders outside the province to those of Newfoundlanders within the province has declined continuously to about 1:7 in 1967-68. Newfoundlanders enrolled anywhere in Canada as a percentage of Canadians enrolled in Newfoundland declined from 200 per cent in 1950-51 to 136 per cent in 1960-61 to 113 per cent in 1967-68.

Students from other parts of Canada enrolled in Prince Edward Island rose from only 27 in 1950-51 to 96 in 1960-61 and a peak of 169 in 1963-64 and again in 1967-68. Enrolments of Islanders elsewhere in Canada continued to grow but less rapidly than enrolments of Islanders in Prince Edward Island. Throughout most of the 1950's numbers of Islanders enrolled within and outside the province were roughly the same, but in 1960-61 they were 484 and 300 respectively, and in 1967-68 they were 1,122 and 446 respectively. Islanders enrolled anywhere in Canada as a percentage of Canadians enrolled in Prince Edward Island declined from 181 in 1950-51 to 135 in 1960-61 and 121 in 1967-68.

The number of Nova Scotians enrolled elsewhere in Canada, rising almost continuously, more than doubled between 1950-51 and 1967-68. Canadians from outside the province enrolled in Nova Scotian institutions also more than doubled during this period. Nova Scotians enrolled anywhere in Canada as a percentage of Canadians enrolled in Nova Scotia increased from 84 per cent in 1950-51 to 88 per cent in 1960-61. The percentage then moved in a range between about 82 per cent in 1963-64 and 87 per cent in 1967-68.

Between 1950-51 and 1961-62 students from elsewhere in Canada enrolled in New Brunswick institutions increased from 694 to 2,084. There has since been an irregular increase to 2,301 in 1967-68. Between 1950-51 and 1960-61 New Brunswickers enrolled elsewhere in Canada declined from 971 to 891. There followed a continuous advance to 1,441 in 1967-68. The number of New Brunswickers enrolled anywhere in Canada expressed as a percentage of Canadians enrolled in New Brunswick was 113 per cent in 1950-51, but by 1961-62 had declined to 77 per cent. Subsequently it rose to 90 per cent in 1966-67, where it remained in 1967-68.

As enrolments rise and costs per student increase, it seems reasonable to expect that provincial governments will resist educating more students from other parts of Canada than the number of local students seeking education in other provinces. In view of past trends, it seems reasonable to assume that, by 1976-77, the number of a province's enrolments anywhere in Canada will equal the number of Canadians enrolled in that province. This position is assumed to hold in 1981-82 and 1986-87. The percentage for 1971-72 is arrived at by interpolation between those of 1967-68 and 1976-77.

Enrolments of Newfoundlanders anywhere in Canada rose from 1.8 per cent of the 18-24 age group in 1950-51 to 2.4 per cent in 1955-56 and 4.2 per cent in 1960-61. This percentage has since advanced continuously to 8.3 per cent in 1967-68.

The corresponding percentage in Prince Edward Island declined from 5.8 per cent in 1950-51 to 5.7 per cent in 1955-56, but it rose to 8.3 per cent in 1960-61. Since that year it has risen irregularly to 13.4 per cent in 1967-68.

The corresponding percentage for Nova Scotia rose from 4.9 per cent in 1950-51 to 5.4 per cent in 1955-56 and 7.0 per cent in 1960-61. Since that year it has risen continuously to 10.5 per cent in 1967-68.

In New Brunswick the percentage rose from 4.4 per cent in 1950-51 to 4.8 per cent in 1955-56 and 6.0 per cent in 1960-61. Since then it has risen continuously to 10.8 per cent in 1967-68.

Meanwhile, the Canadian percentage increased from 4.8 per cent in 1950-51 to 5.1 per cent in 1955-56 and 7.7 per cent in 1960-61. Since then it has risen steadily to 11.8 per cent in 1967-68.

Because number of enrolments and population of university age are both relatively small in Prince Edward Island, that province's percentages have fluctuated rather widely. The 1.6 percentage points by which the Island's percentage exceeded that for Canada in 1967-68 should not be considered too seriously. In this year Nova Scotia and New Brunswick were respectively 1.3 and 1.0 percentage points below the Canadian average. It seems reasonable to assume that by 1976-77 the gaps between individual Maritime Provinces and Canada will have disappeared. It is also assumed that in 1981-82 and again in 1986-87 each of the Maritime Provinces will have the same enrolment as a percentage of the population 18-24, as Canada as a whole. Figures for 1971-72 are reached through interpolation between those for 1967-68 and 1976-77. The ratio in Newfoundland has been running a little over five years behind the Canadian average, and it is assumed that by 1981-82 that province will reach the Canadian percentage for 1976-77. By 1986-87 Newfoundland should reach the Canadian percentage for 1981-82. Figures for 1971-72 and 1976-77 are reached through interpolation between those for 1967-68 and 1981-82.

Sheffield and Also Illing and Zsigmond[1] base their projections of the Canadian percentage on the United States percentage a decade earlier. This gives a Canadian percentage of 18.6 per cent for 1976-77, 20.9 per cent for 1981-82 and 23.5 per cent for 1986-87.

Table C-3

Table C-3 gives full-time enrolments in technician diploma courses (usually of two or three years' duration) for Canada and the Atlantic Provinces for the period from 1951-52 to 1967-68.

1/ E.F. Sheffield, Enrolment in Canadian Universities and Colleges to 1976-77, Ottawa, Association of Universities and Colleges, 1966; and W.M. Illing and Z.E. Zsigmond, Enrolment in Schools and Colleges 1951-52 to 1975-76, Ottawa, Economic Council of Canada, 1967.

TABLE C-3

Full-Time Enrolment of Post-Secondary Students in Technician Diploma Courses at Technical Institutes, Canada and the Atlantic Provinces, 1951-52 to 1967-68

Academic Year	Canada			Newfoundland			Nova Scotia			New Brunswick		
	(1) Enrol-ment	(2) Popula-tion 18-24	(3) (1) as % of (2)	(1) Enrol-ment	(2) Popula-tion 18-24	(3) (1) as % of (2)	(1) Enrol-ment	(2) Popula-tion 18-24	(3) (1) as % of (2)	(1) Enrol-ment	(2) Popula-tion 18-24	(3) (1) as % of (2)
	no.	no.	%	no.	no.	%	no.	no.	%	no.	no.	%
1951-52	2,800	1,508,400	0.2	-	n.a.	-	-	n.a.	-	-	n.a.	-
1956-57	10,400	1,573,300	0.7	-	n.a.	-	-	n.a.	-	-	n.a.	-
1961-62	20,400	1,708,300	1.2	-	n.a.	-	32	72,900	-	78	56,400	0.1
1962-63	20,900	1,765,700	1.2	-	n.a.	-	294	75,600	0.4	149	58,400	0.3
1963-64	23,800	1,844,200	1.3	42	49,400	0.1	76	76,900	0.1	207	59,600	0.4
1964-65	21,900	1,937,000	1.1	181	50,900	0.4	104	79,300	0.1	275	61,000	0.5
1965-66	20,600	2,034,800	1.0	397	52,800	0.8	224	79,500	0.3	319	63,100	0.5
1966-67	31,000	2,149,800	1.4	541	55,700	1.0	350	80,200	0.4	441	66,400	0.7
1967-68	36,200	2,285,500	1.6	639	59,800	1.1	450	84,900	0.5	445	71,600	0.6

Source: Economic Council of Canada, Enrolment in Schools and Universities 1951-52 to 1975-76, Staff Study No. 20, 1967; D.B.S. Education Division and D.B.S. Census Division.

Between 1951-52 and 1963-64 Canadian enrolments as a percentage of the 18-24-year age group advanced from 0.2 per cent to 1.3 per cent. Since then there has been an irregular advance to 1.6 per cent in 1967-68.

Post-secondary technician training in Newfoundland was inaugurated in the school year 1963-64 with the opening of two institutions at St. John's: the College of Trades and Technology and the College of Fisheries, Navigation, Marine Engineering and Electronics. Forty-two enrolments in the first year grew quickly to 639 in 1967-68. In the latter year enrolments came to 1.1 per cent of the youth population.

In Prince Edward Island, post-secondary technician training is expected to become available in the near future.

In Nova Scotia and New Brunswick, post-secondary technician training did not become available until the late 1950's. Such training is available at the Nova Scotia Land Survey Institute in Lawrencetown, Annapolis County, N.S., which opened in 1949. The Nova Scotia Institute of Technology in Halifax was opened in 1963-64. In New Brunswick, the New Brunswick Institute of Technology at Moncton was opened in 1948, and was expanded and renovated in the 1960's. The Saint John Technical and Trade Institute was established in 1963-64. In Nova Scotia in 1961-62 there were only 32 enrolments, and enrolments in subsequent years fluctuated very widely. However, by 1967-68 the number had grown to 450, or 0.5 per cent of the youth population. In New Brunswick in 1961-62 there were 78 enrolments constituting 0.1 per cent of the youth population. There was a more regular advance than in Nova Scotia, to 441 and 445 respectively in 1966-67 and 1967-68. These enrolments constituted 0.7 per cent and 0.6 per cent of the respective youth populations.

During the 1960's, there has been a large expansion in the number of student places and in the variety of courses offered in all three provinces, accelerated by federal-provincial financing under the Technical and Vocational Training Agreements. It would not be legitimate to extrapolate the very short trends available. Illing and Zsigmond[1/] assume that, for Canada, 3.7 per cent of the population 18-24 years of age will be enrolled full-time in 1975-76. In view of the figures for the past few years, it seems not unreasonable to assume that Newfoundland will trail Canada by five years and that Nova Scotia and New Brunswick will trail Canada by 10 years. It is also assumed that Prince Edward Island will trail Canada by 10 years. Adjusting the percentage upward to 3.9 per cent for Canada in 1976-77, this would be the percentage for the Maritime Provinces in 1986-87 and for Newfoundland in 1981-82. Percentages for intervening years are reached through interpolation between 3.9 per cent and the respective 1967-68 actual percentages.

1/ *op. cit.*

Throughout the period, it is assumed that post-secondary enrolments in technicial diploma courses in each province equal enrolments of residents of the province.

Background
Study No 6

WATER RESOURCES of the ATLANTIC PROVINCES

ATLANTIC DEVELOPMENT BOARD

Background Study No. 6

WATER RESOURCES
OF THE ATLANTIC PROVINCES

ATLANTIC DEVELOPMENT BOARD

OTTAWA

1969

FOREWORD

This report is the sixth of a series initiated by the Atlantic Development Board to examine important aspects of the economy of the Atlantic Region. It was prepared as a background document for public discussion of regional development policies.

The Atlantic Development Board Act authorizes the Board to prepare "... an overall co-ordinated plan for the promotion of the economic growth of the Atlantic Region". The various studies that the Board has prepared provide the basic facts on which development policies will be formulated. They are being published to contribute to public understanding and discussion of the major policy issues in the economic development of the Atlantic Provinces.

Water, in the broad context of development, is perhaps the most pervasive of all physical resource requirements. From its life-supporting functions and its role in the production of energy, to its aesthetic and recreational attributes, it is basic to nearly every facet of production and consumption. So basic, in fact, that we tend to be aware of water only when there is too little or too much - or when it "dies" through pollution or neglect.

It takes no more than casual observation to reveal that, as a region, the Atlantic Provinces are endowed with an abundant supply of water. The challenge to the region - given a growing population and industrial base; given a growing demand for water in all its multiple uses - is to so manage its abundant supply that the benefits will be maximized and the conflicts and losses minimized. The opportunity for the region is to lay the foundation for rational and efficient management of its water resources - in time - before problems become crises and conflicts irresolvable.

It was to take the first step toward meeting this challenge and realizing this opportunity that the Atlantic Development Board enlisted the participation of the four Atlantic Provinces and the appropriate federal agencies in undertaking a water resources study. Essentially the objective was to bring together, for the first time on a regional basis, available information on water demand and supply; to forecast future trends; and to identify emerging problems and development possibilities in the over-all context of supply, demand and multiple use. A central task of this initial effort was to reveal gaps in present information and to suggest priorities for future attention.

The resulting studies engaged the energies of four groups of consultants, embracing some 14 different disciplines, over a period of two years. They make up a reference shelf of 46 volumes, books and appendixes. This summary is an attempt to extract the main conclusions of that much larger reference work in such a way that the broad sweep of the findings can be widely circulated and discussed.

The studies were commissioned and financed by the Atlantic Development Board. A Federal-Provincial Supervisory Committee (whose members are listed on page vi) assisted in their formulation and co-ordination, and facilitated the collection of data. The Committee included representatives of the Provinces of Newfoundland and Labrador, Nova Scotia, New Brunswick, and Prince Edward Island; and of the Canada Departments of Energy, Mines and Resources; Fisheries; Finance; Forestry and Rural Development; and National Health and Welfare.

Primary consultants and their assignments were:

Montreal Engineering Company, Limited, Montreal (Maritime Provinces Water Resources Study);

The Shawinigan Engineering Company Limited, in association with James F. Maclaren Limited, both of Montreal (Newfoundland and Labrador Water Resources Study);

Gerard V. LaForest and Associates (The Legal Framework);

Paul C. Leger, Fredericton (The Administration of Water Resources in the Atlantic Provinces).

J.R. Lane co-ordinated the study for the Atlantic Development Board. M.M. Wiggins, Canada Department of Energy, Mines and Resources, served as an advisor to the Atlantic Development Board in technical and administrative aspects related to the comprehensive study, and acted as secretary to the Federal - Provincial Supervisory Committee. David Ross, Vice-president, Hedlin, Menzies and Associates, Ltd., acted as a special consultant to the Committee.

This summary volume is arranged in four parts corresponding to the division of subject matter among the four primary consultants.

Part One considers the water resources of the Maritime Provinces. It summarizes the principal findings and conclusions concerning the quantity and quality of both surface and ground water, and comments on the adequacy of data collection; it analyses present utilization of the resource, forecasts demand to 1981 and identifies emerging problems;

and it suggests priorities for water resource development. Problems and opportunities are delineated for a series of river basins and study areas within the Maritimes.

Part Two, although structured somewhat differently, considers the same range of data in similar terms for Newfoundland and Labrador.

Part Three turns to the legal framework of water resources in the Atlantic Provinces. Here the constitutional position is examined, and common law, statutes and cases are summarized as they relate to the administration of water resources and their many uses.

Part Four suggests a framework for the management of water resources, given the existing legal considerations, and describes and evaluates the present (1968) management system in the Atlantic Provinces and the Government of Canada.

Federal-Provincial Supervisory Committee
Atlantic Provinces Water Resources Study

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John Waugh, Canada Department of Forestry and Rural Development, Amherst, Nova Scotia.

M.M. Wiggins, Canada Department of Energy, Mines and Resources, served as secretary. David Ross, Vice-President, Hedlin, Menzies & Associates Ltd., acted as a special consultant to the Committee.

Participation on the Committee does not imply any measure of responsibility, on the part of individuals or the agencies they represent, for the report or its findings.

LIST OF ABBREVIATIONS

acre-ft	acre-foot (feet)
cfs	cubic feet per second
gal	gallon(s)*
gpcd	gallons per capita per day
gpd	gallons per day
gpm	gallons per minute
hp	horsepower
IHD	International Hydrological Decade
M	million
mg	milligram(s)
Mgd	million gallons per day
mg/l	milligrams per litre
mi	mile(s)
Mw	megawatt (1000 kilowatts)
pH	hydrogen ion concentration
sq	square

* In all cases, gallons refer to Canadian imperial measure.

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WATER RESOURCES
of the
ATLANTIC PROVINCES

PART ONE

THE MARITIMES

PART ONE - THE MARITIMES

1. INTRODUCTION

The Maritime Provinces - New Brunswick, Nova Scotia and Prince Edward Island - are situated on the eastern seaboard of Canada and together with Newfoundland make up the Atlantic Region. Given the locational advantages they enjoy, it is not surprising that much of the history and development of the provinces has been associated with the sea. Nor is it surprising that they shared in the earliest European settlement of the continent.

The terrain, which is varied and interesting, is depicted on Map 1. The Appalachian system of mountains which sweeps up the eastern flank of the continent passes through the region. The upland areas, including the New Brunswick Uplands and the Cape Breton Highlands belong to this system. The eastern portion of New Brunswick and the whole of Prince Edward Island are gently rolling lowlands. The climate is cool and humid and the forests, which cover about 75 per cent of the land surface, belong for the most part to the transition zone between the great pine and spruce coniferous forests to the north and the temperate deciduous woodlands to the south.

The largest rivers flow through New Brunswick and have traditionally facilitated both settlement and harvesting of the forest resources. The Saint John River, the largest river in the region, encouraged the travels and endeavours of early explorers and settlers, and it was quickly recognized that its broad green valley possessed much of the best agricultural land in the province. Nova Scotia and Prince Edward Island are characterized by smaller rivers, but the ease of access afforded by the proximity of the coast to the hinterland compensated for the lack of navigable rivers. Natural harbours abound in each of the provinces. In many areas the coastline is deeply indented. Numerous ports and harbours have grown up over the years and have played a major role in the economy of the region. Halifax, in particular, is endowed with a magnificent natural harbour - and it is not a coincidence that the metropolitan area embracing Halifax, Dartmouth and the surrounding communities is the largest urban concentration in the Atlantic Region.

The Maritime Provinces have always occupied a notable and, in some respects, a special place in the history and development of the North American continent. The first permanent settlement north of Florida was established in Nova Scotia, and the struggles between the French and the British to secure and hold strategic points such as Louisbourg reveal the importance attached to the region by the imperial powers during the 17th and 18th centuries.

Gradually the military emphasis gave way to the exploitation of the forest resources and to a thriving agriculture. The days of "wood, wind and water" saw prosperity and a booming economy based on lumber for masts and hulls. Shipbuilding in the Maritime Provinces was a major industry, and exports of lumber to Great Britain were extensive. With the arrival of the age of steam and iron ships, which roughly coincided with Confederation and the entry of the Maritime Provinces into the Canadian union, prosperity began to slacken.

Shipbuilding declined rapidly, from almost 200,000 tons in 1864 to only 53,000 tons in 1882, and the provinces found that their economy was, in many respects, competitive with, rather than complementary to, that of the rest of the new nation.

Toward the end of the 19th century prosperity returned and continued until the end of World War I. The coal mining and iron and steel industries in the Sydney area of Nova Scotia saw rapid growth. Farmers realized the advantages of specialization in produce best suited to the resources available, for instance dairy products, apples in the Annapolis Valley and potatoes in Prince Edward Island and New Brunswick. Lumbering increased, and a groundwood pulp industry developed.

The depression of 1929-39 affected the Maritime Provinces as it did all of North America and Europe. All sections of the economy experienced great difficulties. World War II brought another boom to the resource-based industries of the region due to the intense demand for raw materials by the western allies, but prosperity was short-lived.

The average per-capita income in the Maritime Provinces in the three-year period 1963-65 was $1,320 which was 71 per cent of the average value of $1,849 for Canada. Even recognizing the limitations of per-capita income as a measure of the region's welfare, it is clear that the economy of the Maritime Provinces lags substantially behind that of the country as a whole.

In recent years efforts to foster the economy of the Maritime Provinces have been accelerated. It is relevant to note that federal development expenditures, including revenue equalization payments (as defined in the Fifth Annual Review of the Economic Council of Canada) averaged $216 per capita in the Maritime Provinces compared with $133 per capita in the country as a whole.

Map 2 illustrates the economic activity in the Maritime Provinces at present and shows the more important elements of the infrastructure. The population of the three provinces in 1966 was 1,482,000; the population of New Brunswick was 617,000, Nova Scotia 756,000 and Prince Edward Island 109,000.

Today the forests still form the foundation of the economy but the emphasis has shifted to the production of pulp and paper. Fishing and agriculture have been declining in relative terms for many years but are still important. In recent years, due to greater efforts by both the public and the private sectors, there has been an upsurge in manufacturing and industrial activity, best exemplified, perhaps, by the developments in the Strait of Canso and Belledune areas. The latter stems from the discovery and exploitation of major basemetal mineral deposits in northeastern New Brunswick which are likely to play an increasingly important role in the economy of that province. In contrast, coal mining in Nova Scotia has suffered a very severe decline, and the future of the industry is in doubt.

Uncertainty attends the future of agriculture in the Maritime Provinces. In common with agriculture everywhere in Canada, technological improvements and changes have exerted new pressures on the industry, and with other factors, such as changes in markets and prices, have intensified competition. The future of Maritime agriculture will depend largely on the extent to which farmers adapt to the new technology, move toward farm consolidation and seize opportunities as they arise. There are encouraging signs that in areas where the land and climate offer significant advantages, the necessary changes are beginning to be made and that a modern, viable agriculture may be emerging.

The fishing industry is also undergoing a period of adjustment. The offshore fishery is receiving increasing emphasis but has been suffering because of a drop in world prices. Fish processing continues to be an important element in the economy of all three provinces, especially Nova Scotia, but it is hampered by the proliferation of small plants and the consequent need for rationalization. Lobsters, Atlantic salmon and oysters make up most of the landed value of the inshore fishery. There is potential for major expansion of the oyster fishery based on improved farming techniques and the introduction of disease-resistant strains, but otherwise the commercial inland fishery is likely to remain generally at current levels.

Tourism is an industry of increasing importance in each of the provinces. The scenic vistas offered, the variety of activities available and the character of both the environment and the people are a source of pleasure to both visitors and residents alike. The opportunities for angling Atlantic salmon in New Brunswick, the coastal scenery of Nova Scotia and the beaches of Prince Edward Island are assets of immense importance.

For more than a hundred years, many of the region's educated people have been leaving to seek better opportunities elsewhere, in turn contributing to the economic problems at home. The outlook is changing, however. While the prosperity

gap may not have been closed, it has not been allowed to widen in recent years. Moreover, there is an increasing awareness of the problems to be overcome and an increasing desire to tackle these problems and move ahead more rapidly. The comprehensive development plan for Prince Edward Island illustrates the realistic approach now being applied to the problems of the region. The reform of the educational system introduced into New Brunswick in 1968 is another example.

Hand in hand with progress and development, however, will be the need to ensure that one of the Maritime Provinces' most important assets, the quality of the natural environment, is not being unnecessarily sacrificed.

2. PRINCIPAL FINDINGS

This summary of the Maritime Provinces Water Resources Study is divided into three sections. The first section presents a brief description of the quantity and quality of the water resources. The second section presents in somewhat greater detail the utilization of the resource, current and future, and focuses on the problems, conflicts and opportunities which have been exposed. The third section identifies issues which, it is believed, should receive high priority in the region as a whole.

THE RESOURCE, ITS QUANTITY AND QUALITY

The water resources of a region are an important factor in its development and welfare. An abundance of good quality water can play an important role in economic growth, whereas scarcity can be a significant handicap. In the succeeding paragraphs, a brief outline of the water resources of the Maritime Provinces is presented. The objective is to highlight both the favourable characteristics and the deficiencies in terms relative to the water resources elsewhere in Canada and North America.

Quantity

Nature has endowed the Maritime Provinces with an abundance of water.

The Maritime Provinces have a cool humid climate of the modified continental type. The general movement of air masses is from west to east, and air reaching the region has usually originated over the continent. Influxes of moist Atlantic air may produce abnormal warm spells during the winter and cool weather during the summer. Storms can occur at virtually any time of the year, but tend to be more severe and frequent during the winter months. Precipitation is generally abundant throughout the region but there are marked variations. The mean annual precipitation varies from 30 inches in eastern New Brunswick to 70 inches in the highlands of Cape Breton. The mean annual precipitation in the three Maritime Provinces is estimated to be: New Brunswick, 41 inches; Nova Scotia, 51 inches; and Prince Edward Island, 40 inches.

The estimated average annual surface runoff in the region is presented in Table 1-1.

TABLE 1-1

Average Surface Runoff, Maritime Provinces

Province	Inches	cfs/sq mi	cfs	acre-ft	Mgd
New Brunswick	26.5	1.95	72,900	52,800,000*	39,200*
Nova Scotia	37	2.72	58,200	42,000,000	31,200
Prince Edward Isl.	24	1.77	3,900	2,800,000	2,100
Maritime Provinces	31	2.26	135,000	97,600,000	72,500

* Includes runoff entering New Brunswick from Québec and Maine.

Moreover there is an abundance of ground water in many areas, notably from the bedrock underlying the New Brunswick lowlands; the whole of Prince Edward Island (if properly managed); and from the sands and gravels found along the major rivers in New Brunswick and Nova Scotia, such as the Annapolis-Cornwallis Valley.

The abundance of the water resources of the Maritime Provinces represents a major asset to the region but does not negate the need for sound comprehensive management and conservation.

Unfortunately, in many parts of the world, the need for sound comprehensive management and conservation has been recognized only when the demands on the resource created scarcity and problems of allocation. The opportunity to manage the resource properly, and thereby minimize conflicts and problems in the future, must be seized.

Surface Water

The intensity of average surface runoff varies over a relatively wide range.

The maximum average annual intensity is estimated to be 60 inches (4.4 cfs/sq mi) in the Cape Breton Highlands and the minimum is estimated to be 20 inches (1.5 cfs/sq mi) at the eastern extremities of Prince Edward Island. Parts of central New Brunswick also have low intensities of the order of 22 to 25 inches (1.6 to 1.8 cfs/sq mi).

> Generally, there are two peak runoff periods, one in the spring caused by rainfall and melting snow and the other in the fall or early winter caused mainly by heavy rainfall.

In Prince Edward Island, the fall runoff is not nearly as pronounced as it is in the other provinces. There is a tendency toward higher runoff in December and January, with moderately high flows in the spring. In New Brunswick, the smaller low-gradient streams along the east coast may be expected to exhibit a runoff pattern similar to those in Prince Edward Island. On the other hand, the larger rivers draining inland areas tend to have a small peak runoff in the late fall and a very high peak in April or May. The runoff in most of Nova Scotia peaks significantly in the fall or early winter and more sharply in the spring during April or May.

> Low streamflows usually occur each year during the summer and early fall throughout the region. Low streamflows also occur during the winter and tend to be most pronounced in New Brunswick.

In some areas, streamflows may drop to practically zero during extremely dry periods. Consequently with the exception of the larger rivers in New Brunswick having substantial baseflows, storage must be created to provide dependable flows of any magnitude.

> Opportunities to regulate the flow of the smaller streams and rivers by creating storage are numerous in the upland areas, but opportunities to create sufficient storage to substantially regulate the flow of the larger rivers (Saint John, Miramichi, Restigouche, etc.) are severely limited.

The availability of good storage sites is indicated in a general way by the number and size of existing lakes. Prince Edward Island, the eastern and northeastern lowlands of New Brunswick and the Cumberland Lowlands are deficient in this respect. Development of streams in these areas to provide even small dependable flows is usually expensive and often not practical.

> Floods can occur at any time of the year but are less frequent in the summer months.

The annual maximum flood usually occurs in the spring and is generally caused by heavy rainfall superimposed on snowmelt. Floods can be caused by thunderstorms over small drainage basins; by subtropical storms; by snowmelt or by a combination of these factors. The danger of hurricanes spawned in the Caribbean reaching the Maritime Provinces during the summer and autumn, and the danger of a sudden thaw with heavy rainfall in the winter make flooding possible at any time of the year.

Ground Water

> Bedrock and overburden aquifers in New Brunswick contain large volumes of essentially untapped ground water. Carboniferous rocks comprise the best bedrock aquifers. Extensive overburden deposits are found along the major rivers in New Brunswick and are suitable for large ground-water supplies.

Approximately 37 per cent of the area of the province, an area that coincides with the New Brunswick Lowlands, is underlain by Carboniferous rocks which are the best aquifers. Wells located in these rocks are capable of yielding from 20 to 500 gpm each. Eighty-eight existing wells located in these rocks, with yields reported, yield a median of 220 gpm. Good quality water is usually obtained from these rocks. Localized areas within these rocks are of marine origin (Windsor Group) and can yield water with very high mineral content that is unsuitable for municipal use. Windsor rocks are encountered along the southern and western edges of the New Brunswick Lowlands and in the Tobique and Plaster Rock areas. Other rocks underlying the province are relatively poor sources of ground water, usually yielding from 1 to 20 gpm of good to variable quality water. Most of the province is overlain by glacial till which is generally a poor source of ground water. Overburden deposits that are likely to yield large ground-water supplies, above 100 gpm, are found along many of the larger rivers. In favourable locations overburden deposits may yield 500 to 1,500 gpm per well. The favourable deposits are: stream alluvial deposits; undifferentiated valley-train outwash and kame-terrace deposits; and pitted and unpitted outwash and outwash-delta deposits. Low areas that obtain natural recharge from nearby surface water systems are the best places to search for high-capacity overburden aquifers.

> In Nova Scotia, bedrock and overburden aquifers in certain locations can be expected to yield large quantities of ground water. Ground-water resources of both the bedrock and overburden materials are considerably poorer in Nova Scotia than they are in New Brunswick.

Post-Windsor sedimentary rocks which underlie the lowlands of the isthmus, the Annapolis-Cornwallis Valley and parts of the lowlands surrounding the Bras d'Or Lakes comprise the best bedrock aquifers; wells in them may yield 5 to 500 gpm each of good quality water. Windsor Group rocks which can yield highly mineralized water unsuitable for municipal use underlie larger areas in Nova Scotia - principally, much of the Shubenacadie-Stewiacke River Basin, the environs of Windsor and a number of locations surrounding the Bras d'Or Lakes. Most of the Atlantic Uplands are underlain by rocks which usually yield less than 5 gpm of good to variable quality water.

Ground-water resources of the overburden materials in Nova Scotia are considerably poorer than they are in New Brunswick. A large part of Nova Scotia is dominated by bedrock at or near the surface. Till deposits are the most widespread unconsolidated soil materials. Furthermore, the rivers of Nova Scotia are smaller than the major rivers of New Brunswick, consequently the good overburden aquifers associated with the rivers are fewer in number and also smaller in extent. The largest known surficial aquifers in Nova Scotia are found in the Annapolis-Cornwallis Valley.

> In Prince Edward Island, bedrock aquifers almost anywhere can be expected to yield good quantities of water. Ground water in the overburden deposits has remained virtually undeveloped because of the excellent source available in the bedrock. Generally, overburden deposits on the Island will not be as good a source as the bedrock.

The Permo-Carboniferous rocks that underlie all of the Island are similar to the rocks underlying the best aquifer regions in New Brunswick and wells in them are capable of yielding 20 to 500 gpm each.

Quality

> In general, the surface waters of the Maritime Provinces are of good chemical quality.

Mostly the surface waters are soft, but medium-hard waters are prevalent in Prince Edward Island and western and northern New Brunswick - particularly in the northwest corner of the province, in streams draining the Chaleur Uplands, and in streams flowing from Maine into the Saint John River below Grand Falls. In Nova Scotia medium-hard waters are encountered in parts of the Annapolis-Cornwallis, Shubenacadie-Stewiacke and River Philip Basins and in a few other localized areas.

The most widespread and serious defect is colour, which is usually associated with soft water. Waters draining from the Atlantic Uplands in Nova Scotia, in particular, are very soft, usually highly coloured, acid and corrosive. Medium-hard waters are fairly clear. Turbidity can be high at times in many areas, particularly in streams draining croplands in New Brunswick and Prince Edward Island and in the tidal reaches of streams flowing into the Bay of Fundy.

> Many of the inland surface waters are polluted, and pollution is widespread in the harbours, estuaries and inshore waters.

Man's activities, principally the disposal of wastes, have detrimentally altered the quality of numerous streams, estuaries and inshore areas, despite notable progress in recent years toward pollution control and abatement. Beneficial uses are being inhibited and often precluded in the polluted zones. Maps 3, 4 and 5 illustrate a subjective judgment of the present state of pollution in the Maritime Provinces. Although the disposal of untreated or inadequately treated municipal and industrial wastes is by far the prime cause of pollution, mining, bark deposits remaining from log-driving operations, agricultural wastes, pesticides and soil erosion are also important contributors.

> The quality of ground water in the Maritime Provinces is generally adequate for domestic use. Adverse quality constituents are found, however, in several locations. Salt-water intrusion, high iron and manganese content, and high dissolved-solids content associated with certain rocks are the recurrent quality problems.

In New Brunswick the most common adverse quality constituents are iron and manganese, which may be encountered in many areas of the province. These constituents are often found near areas of swamps and bogs. Salt-water intrusion is found along the coast. High chlorides and sulphates are found in some inland areas and are often associated with the Windsor Group rocks.

In Nova Scotia, the quality of ground water is generally adequate for domestic use. However, some areas of Nova Scotia are underlain by the Windsor Group rocks, and the quality of ground water in these areas is usually very poor. Other ground-water quality problems occurring in Nova Scotia are high iron and manganese content, excessive hardness, and salt-water intrusion. High iron and manganese content is a common problem and has been extensively reported in parts of the Atlantic Up-

lands; it is often associated with the presence of swamps. Salt-water intrusion is also a recurring problem and is reported in many coastal areas, especially in the smaller communities along the coast having fish-processing plants.

In Prince Edward Island, the quality of ground water, which is almost exclusively taken from bedrock aquifers, is generally good. Salt-water intrusion has been experienced in several areas - principally Summerside - and is the major water supply problem on the Island. Because of the relatively small size of the drainage basins and the proximity of the sea or brackish estuarine water to many centres of population on the Island, salt-water intrusion has been a fairly common problem.

> Although the water quality is generally satisfactory from ground-water sources in the Maritime Provinces, pollution in wells is encountered in many areas. The common pollutants are excessive nitrates which are most liable to seep into shallow dug wells and into poorly constructed deep wells.

Excessive nitrate content is reported in many wells in the Maritime Provinces. The nitrate content is indicative of seepage of sanitary wastes, farmyard drainage, and fertilizers into the aquifers. Shallow dug wells are most prone to this type of pollution. Poorly constructed deep wells also have been contaminated by excessive nitrate content. Pathogenic contamination is also reported in some areas and is associated with the same sources and conditions that allow infiltration of nitrates into wells. Surface leakage of gasoline and oil has also been reported to have polluted some aquifers.

Data Collection

Data collection should seek to provide adequate information for management of the resource, including the planning, design and operation of developments. Sound management of the water resource depends in large measure on the availability of adequate data. The value of data on supply, to a greater degree than data on demands, is often proportional to the length of the period of record - for example, precipitation and streamflow measurement - and it is important to anticipate needs as early as possible. Moreover, since the specific purposes or uses cannot be fully foreseen, the data collected should be as broadly representative as possible. This implies careful planning of networks and systems, whatever type of data is being collected. For example, the data collected should indicate areal and time distribution and changes, and should be collected and assembled in a consistent manner.

Specific problems and development possibilities may require more intensive and extensive data collection which has to be initiated as and when the need arises.

> There is an imbalance in the availability of data on the resource suitable for management and planning. Data useful for hydrogeologic interpretation and, to a lesser extent, data on water quality, lag behind data on surface water quantity.

Much of the data collection on ground water and water quality has, in the past, been directed toward specific problems and localized objectives with the result that large areas of the region have little or no coverage (notable exceptions are the IHD water quality program and programs undertaken by the Nova Scotia Department of Mines), and often the data collected have not been comprehensive enough to permit useful interpretation.

Objectives need to be established, and problem- or development-oriented measurements and data collection must be undertaken in accordance with clearly defined priorities.

All water resource data collection programs should be closely integrated and strongly co-ordinated. Surface-water quantities, ground-water quantities and the quality of both are interrelated, and substantial savings in cost may be achieved by integration and co-ordination.

> Particular attention needs to be given to: collection of ground-water data; expansion of base-line networks for surface-water quality data; and the monitoring of water qualities in critical areas.

The available data on ground water are scant, and recently-initiated efforts to improve the quantity and quality of the data should be supported and intensified. The existing IHD water quality network should be expanded and co-ordinated with hydrometeorological network planning. Water quality monitoring in critical areas should be undertaken in accordance with priorities and objectives established by the administrative agencies.

> A multiplicity of federal, provincial and municipal agencies is taking measurements and collecting data on the resource. It would be extremely valuable to have a central data bank established in each province.

There is a pressing need to centralize the assembly and storage of water resources data so that all information required for management, planning and development is readily available and is published in a systematic way.

When data banks are established, procedures should be drawn up to ensure that copies of all analyses and records are forwarded to each provincial data bank. The New Brunswick Water Authority, the Nova Scotia Water Resources Commission and the Prince Edward Island Water Authority should have prime responsibility for their respective provincial data banks.

> The data should be processed, stored and retrieved by electronic computer wherever feasible and identical formats and programs in each province should be used. A central data bank for the entire region should be considered and evaluated; a central data bank would be more economical than three separate provincial data banks.

The electronic data processing system for water quality data, developed during the course of this study, would provide a useful basis for processing quality information in the future.

PRESENT AND EMERGING UTILIZATION OF THE RESOURCE

Domestic, Commercial, Municipal and Industrial Freshwater Demands

> The quantity of water demanded for domestic, commercial, municipal and industrial purposes in 1966 was a very small proportion of the total supply available. Increased utilization in the period to 1981, and indeed beyond, will not change this situation significantly.

The quantity of water used in 1966 and the forecast demands in 1981 are summarized in Table 1-2.

When the values are compared with the estimates of the total supplies available, it is apparent that the degree of utilization for these withdrawal demands is extremely small.

The level of per-capita demand for domestic, commercial, municipal and all small industrial uses is related to the

TABLE 1-2

Domestic, Commercial, Municipal and Industrial Demands, 1966, with a Forecast for 1981

Province	On Public Utilities						Not on Public Utilities				Total	
	D C & M		Industrial*		Total		D C & M		Industrial			
	1966	1981	1966	1981	1966	1981	1966	1981	1966	1981	1966	1981
	Mgd				Mgd		Mgd				Mgd	
New Brunswick	27	38	35	49	62	87	22	29	129	180	213	296
Nova Scotia	35	43	6	10	41	53	20	21	72	121	133	195
Prince Edward Isl.	3	4.5	0.5	1.5	3.5	6	4	5.5	3.5	3.5	11	15
Total	65	85.5	41.5	60.5	106.5	146	46	55.5	204.5	304.5	357	506

* Major water using industries - using at least 5,000 gpd or 375,000 gal per quarter.

population of the community, the percentage of consumers metered and the proportion of public sewer connections. To a lesser extent, income and price also influence the level of demand. The values of per-capita demand in 1966 together with the range of values of an optimized sample (extreme values for which no explanation can be provided have been omitted for maximum and minimum values) are as follows:

	Per-Capita Demand in 1966		
	Maximum	Minimum	Average
		gpcd	
New Brunswick	142	45	99
Nova Scotia	99	31	72
Prince Edward Island	89	45	70
Maritime Provinces	142	31	84

The per-capita demand is expected to increase to an average of 95 gpcd in the region as a whole by 1981. The wide range of per-capita demand values in 1966 is expected to be substantially narrowed by 1981.

> It is clear that problems and opportunities in the supply of water to meet these demands will emerge at the level of individual municipalities and industries rather than in the region or each province as a whole.

Analysis of demand and supply in the region or each province as a whole is useful only to indicate in very broad terms the aggregate utilization and availability of the resource. Meaningful analysis can be achieved only by considering individual centres of population and economic activity (Study Areas) and selected River Basins.

> In Prince Edward Island, all demands for domestic, commercial, municipal and industrial purposes are met by ground-water sources. In both New Brunswick and Nova Scotia 22 per cent of these demands are supplied by ground-water sources.

These statistics reflect the general availability and economics of ground-water supplies versus surface supplies. It is important to point out, however, that tradition and attitudes

rather than economics can sometimes influence the selection of the source; both possibilities need to be assessed and compared when major development or expansion is contemplated, unless the choice is quite clear-cut.

> In the Maritime Provinces, 48 per cent of the population is supplied by public utility systems. Most of the remainder rely on individual drilled or dug wells.

The breakdown by provinces is: New Brunswick, 48 per cent; Nova Scotia, 50 per cent; and Prince Edward Island, 32 per cent. Several communities, notably Halifax, Truro, Bathurst and Georgetown are planning major extensions to their distribution systems to serve new areas.

> Sixty-two per cent (74 utilities) of the utilities surveyed during the course of this study (which included virtually all utilities) indicated serious problems or inadequacies.

Problems and inadequacies indicated by municipal authorities are classified in Table 1-3.

TABLE 1-3

Water Utility Problems by Type

Province	Total Utilities Surveyed	Type of Problem or Inadequacy			
		Source of Supply	Transmission and Distribution	Water Quality	Total Affected
New Brunswick	43	10	17	24	34
Nova Scotia	70	7	31	12	38
Prince Edward Isl.	6	2	1	1	2
Total	119	19	49	37	74

It should be appreciated that most utilities will have to undergo varying degrees of expansion to meet future demands. This is consistent with good development planning. The primary objective of any public utility must be to provide satisfactory service at minimum cost. The burden of excessive unused capa-

city should be avoided by staging development. Moreover most of the "source of supply" and "transmission" problems are related to the present level of demand and it is apparent that, for one reason or another, there has been inadequate planning or action to maintain satisfactory service.

The inadequacy of distribution and transmission facilities is usually synonymous with inadequate fire protection. The water supply system in a community is responsible for 34 per cent of that community's fire insurance rating. Thus a community with a poor supply not only endangers the protection of its population but also commands high insurance rates. This in turn encourages many households to forego fire insurance coverage.

Some water supply systems in the Maritime Provinces have an unusually large proportion of old facilities in service reflecting a stagnant or declining population and economy over a long period of time. Extensive replacement and renovation during the study period may become necessary and involve major investments.

> The analysis of demand and supply undertaken in this study has generally confirmed the concerns indicated by the municipal authorities. In a few cases the analysis has revealed a more serious situation. In several cases the analysis has exposed new options and alternatives which should be taken into account by the authorities before deciding on a specific course of action.

The comprehensive approach to water resources development and management afforded by the terms of reference of this study has allowed the identification of a number of development possibilities, some with multi-purpose implications.

> Expansion of existing utilities to meet the forecast demands in 1981 will likely require a total expenditure of the order of $50 million.

This estimate is of necessity very rough but is useful as an indication of the scale of the investment that will be required. It is not possible to estimate the scale of the investment that would be required to rectify the inadequacies and upgrade the quality of service of the 74 utilities known to have serious deficiencies but it would undoubtedly be very substantial. If undertaken on a broad front across the whole region the costs could approach a similar order of magnitude.

> The prices charged for domestic, commercial and industrial water supplies vary widely but the averages are close to the averages for Canada as a whole. High prices tend to be associated with utilities which have recently undertaken major improvements or expansions. Low prices tend to be associated with utilities using an unusually high proportion of old facilities and serving communities which have experienced a stagnant or declining population for many years.

In Nova Scotia, the revenue that a public utility can earn is regulated and is based on the depreciated value of the facilities in service plus an allowance for new facilities under construction. The rate base of several utilities is small due to age and the lack of new construction. Consequently, the rates these utilities are permitted to charge are low. The per-customer debt of utilities in the Maritime Provinces varies from a low of zero to a high of $1,290 and averages $236. The pattern of per-customer debt follows closely the pattern of water rates and prices, as might be expected.

> There is evidence that many utilities, particularly the smaller ones, suffer from a lack of technical and management skills.

The most prominent indication of this deficiency is the apparent lack of knowledge of fundamental system data. Of 111 utilities reviewed, 82 per cent were able to state their average demand, only 33 per cent were able to state their peak daily demand and only 14 per cent were able to state their peak hourly demand. Many of the values given were estimated rather than measured. In many instances important data on sources of supply and facilities were not readily available. Effective and efficient management of a utility is dependent on good records - both technical and financial - and an intimate knowledge of the system characteristics.

> Each province should undertake a review of the utilities in the province and provide management and other assistance wherever necessary.

The review should consider the condition of the facilities, finances, policies, planning and personnel. (The information provided in the report which is summarized here could constitute the starting point for such a review.) Following this each province should formulate comprehensive policies and procedures aimed at:

- maintaining adequate records and technical data

- upgrading substandard facilities and service

- rationalizing rates and rate policies

- amalgamating adjacent utilities where technically and financially desirable

- providing technical and management skills where needed

- taking any other steps necessary to ensure that in all communities the public receives good service at the least possible cost.

The controls and procedures enforced by the Nova Scotia Board of Public Utility Commissioners provide useful financial and statistical data and are to be commended. It is suggested that similar practices be instituted in New Brunswick and that the existing procedures in Prince Edward Island be broadened.

> The survey of major water-using industries in the Maritime Provinces has revealed that 68 of a total of 189 have private supplies. Of these, only 9 indicate inadequacies of one sort or another and it is concluded that private industrial supplies are in general satisfactory.

Industries drawing their water from municipal utilities often confirmed the water quality shortcomings indicated by the utility itself. In a few instances, industries stated that the quality was inadequate or unsatisfactory although the utility itself reported the quality to be satisfactory. Such instances may suggest that the quality of the service needs further evaluation. On the other hand, it must be stated that no industry should expect the quality of the utility supply to be better than the quality demanded by the utility's domestic customers, unless special arrangements are made.

> The water demands of pulp and paper mills in the Maritime Provinces account for 84 per cent of the total demands by major water-using industries.

Pulp and paper mills account for 89 per cent of total demands by major water-using industries in New Brunswick and 75 per cent in Nova Scotia. There are no pulp and paper mills in Prince Edward Island, but food-processing plants in the province account for 65 per cent of the total demand by major water-using industries.

> Of the water-using industries in the Maritimes, only in the case of the pulp and paper industry and to a lesser extent the iron and steel industry is the cost of intake water a significant factor in the over-all cost of production.

A study of 15 major water-using industries relevant to the Maritime Provinces has indicated that, with the exception of the pulp and paper and iron and steel industries, the cost of intake water is usually less than 1 per cent of the total production cost and that over the normal range of intake water prices, the demand is relatively insensitive to cost. On the other hand, the cost of intake water may represent up to 3 per cent of the cost of production in pulp and paper mills and can influence water demand significantly. These conclusions imply that the cost of water is a minor and often negligible factor in the locational decision of all industries examined other than the pulp and paper and iron and steel industries.

> The cost of modern treatment facilities, capable of removing most of the solid and oxygen-demanding wastes, is a significant factor in the over-all cost of production of all the major water-using industries studied and can influence the quantity of intake water demanded.

In most of the industries studied, the cost of modern waste treatment facilities represents 2 to 3 per cent of the cost of production, which (with the exception of the pulp and paper and iron and steel industries) is several times greater than the cost of intake water. The cost of waste treatment is closely related to the volume of wastes and consequently well-managed industries will seek to optimize water utilization as a whole by recirculation and by process modifications if they have to meet stringent effluent quality controls.

> Recirculation of water is practised to a relatively minor degree by industries in the Maritime Provinces.

There appears to be ample opportunity for major water-using industries in the Maritime Provinces to reduce the intake water demand by greater recirculation of water. Comparisons with industries in the United States indicate that recirculation in plants in the Maritime Provinces is invariably lower. This undoubtedly directly reflects the cost of water; significantly greater recirculation will probably not take place until the total cost of water utilization increases above present levels. There is no evidence that sea water will be substituted for

fresh water to any significant extent by the major water-using industries in the Maritime Provinces. Sea water is used widely, particularly by the fish-processing industry, but pollution of inshore waters, often due to the fish plants themselves, may lead to greater use of fresh water to avoid the high cost of extensive treatment of sea water.

Fisheries

The fisheries of the Maritime Provinces are a prime natural resource.

The inland and estuarine waters of the Maritime Provinces support a wide range of species of fish, shellfish, crustacea, marine animals and plants. The value of landings from the commercial inshore fishery in 1967 was some $33 million, just over half of the total inshore and offshore commercial fishery. Fresh-water-dependent species and estuarine and intertidal shellfish accounted for approximately $2.6 million. Two species, Atlantic salmon and oysters, made up two thirds of the value and, as shown in the following tabulation, a rapid growth of the oyster fishery is anticipated.

	Value of Landings		
	1967	1981	
		Conservative	Optimistic
	$ 000	$ 000	$ 000
Atlantic Salmon	1,095	1,000	1,500
Oysters	650	2,000	3,000

Many rivers, especially the Miramichi, Restigouche, Saint John and Margaree, are renowned for their populations of Atlantic salmon and the outstanding opportunities for angling this fish that they possess. Two hundred thousand adult Atlantic salmon return to the Miramichi each year and it is generally regarded as the foremost Atlantic salmon river in North America, if not the world. Speckled trout thrive in most of the brooks, streams and rivers of each of the provinces, especially in Prince Edward Island.

The estimated annual value of the sport fishery in New Brunswick in 1968 was $10.4 million and is expected to double by 1981. The importance of the sport fishery to the economy of the province is apparent. The value of the sport fisheries in Nova Scotia and Prince Edward Island cannot be estimated due to lack of data but they are believed to be substantial.

Man's activities have already taken a heavy toll on the fisheries of the Maritime Provinces and threaten to deplete the resource still further unless adequate measures are taken.

Until recent years, the development of hydroelectric power was often accomplished with inadequate provisions for maintaining populations of anadromous fish (e.g., salmon). Early settlers noted that the salmon stocks of the Mersey and East (Sheet Harbour) Rivers were among the best in Nova Scotia. The development of hydroelectric power on these rivers has virtually destroyed the salmon fishery. The St. Croix River once supported an excellent run of Atlantic salmon but with the construction of dams at Milltown and Woodland in the early years of the century and severe pollution by pulp mill wastes ever since, the run has been completely eliminated. Recent hydroelectric developments, notably Mactaquac and Beechwood on the Saint John River, have incorporated modern facilities to maintain the salmon fishery but losses will still take place.

In the early 1950's New Brunswick mounted an intensive forest-spraying program to combat the spruce budworm. The chemical used was DDT and there were devastating effects on fish and wildlife. Since then better techniques, less harmful chemicals and reduced intensities have been introduced, the fishery has recovered and the apparent effects are now insignificant. The long-term effects are, however, still largely unknown.

The most serious threats to the future of the fresh-water-dependent fisheries are wastes originating from base metal mines in central and northern New Brunswick and pulp mill and other wastes discharged into the Miramichi and Restigouche estuaries and to a lesser extent, the Saint John estuary.

Wastes from base metal mines can contain zinc and copper which are highly toxic to fish. Present mining activity has already caused losses in the Northwest Miramichi and one of its tributaries. The possibility of greatly increased mining activity in the future emphasizes the need for a solution to the problem. The pulp mill wastes tend to form pollution barriers which, if they ever extend across the whole estuary, could conceivably destroy the salmon fisheries. There are indications that this eventuality may not be too far away in the case of the Miramichi. Increased production or further expansions of the mills, which have been forecast to take place before 1981, will pose a major threat.

> The most serious threat to the shellfish resources in the estuaries and inshore waters has been, and will continue to be, contamination by domestic sewage, if adequate treatment is not introduced. In 1968, a total of 181 shellfish closures was enforced, due to bacterial contamination.

The oyster fishery of the Maritime Provinces is an important natural resource. Two areas stand out in this respect, Malpeque Bay in Prince Edward Island and the Miramichi estuary and Bay in New Brunswick. Domestic and industrial pollution has not yet reached major proportions in Malpeque Bay but it has occurred in the past and does pose a threat. A more immediate threat may be posed by siltation. The Miramichi oyster fishery was decimated some years ago by disease unrelated to pollution. The development of disease-resistant strains, together with advances in the production of seed oysters indicate great potential for the Miramichi oyster fishery provided contamination is prevented.

> It is suggested that further research and data collection be undertaken so that issues related to the benefits and costs of fisheries activities, particularly the sport fisheries, can be evaluated on a direct quantitative basis.

There is a requirement for data that will enable various types of specific economic appraisals and proposals to be objectively weighted and explored in the future. Even more important is the need to work on improving the measurement of benefits so that objectives can be developed in relation to closer approximations of real value in place of the partial and conservative estimates made in this study.

Both the general scarcity of data and the nature of the question that has been dealt with in this study, i.e., the present and forecast value of the fresh-water-dependent fisheries, have meant that numerous assumptions had to be made and various valuation tactics employed to fit the varying institutional and economic arrangements encountered. Prime emphasis must be given to the economic potential in fisheries development, and the optimal sport/commercial utilization that this would involve. This again points to the need for appropriate research on commercial and sport fisheries management concepts and data so that this potential can be identified, appraised and acted upon in the public interest.

> The federal-provincial mechanisms necessary for sound administration of the fisheries resource have been established. However, there is evidence that, in certain instances, a lack of confidence prevails and closer co-operation is necessary. Jurisdiction with respect to fisheries was assigned to the federal authority but the provinces, with jurisdiction over property and civil rights, have important responsibilities.

The interrelationship between the administration of the fisheries resource and the administration of property and civil rights makes it essential that the policies of both levels of government be consistent with their common objective - the efficient management of fisheries resources.

Recreation

> The major attraction of the water resources of the Maritime Provinces for the non-resident tourist is the ocean front.

The scenery and recreational opportunities of the coast in each of the provinces offer comparative advantages in relation to much of the primary tourist market. Generally, fresh-water resources play a secondary, albeit important, role in tourist activity apart from angling and cottaging in certain watersheds such as the Miramichi, Restigouche and St. Croix.

Fresh-water resources occupy a much more important position in the over-all resident tourist and recreation patterns. Most of the residents of the Maritime Provinces live in close proximity to the ocean front and, with the exception of the inland reaches of the Saint John River, the fresh-water opportunities must face strong competition from marine resources for the attention of the populace. On the other hand, the fresh-water lakes and rivers possess a variety of opportunities and offer significant locational advantages for residents living substantial distances from the ocean front.

> In the period to 1981, a steady and significant growth in tourism and recreation is expected. Provided that there is adequate planning and public development, the supply and quality of the marine and fresh-water resources appear to be adequate in scale and quality.

Some estimates forecast an explosive growth in recreational and tourist activity in the Maritime Provinces in the long term. Due to the multiplicity of factors influencing demand, some in a positive direction, others negative, a steady but significant growth rate has been favoured in this study.

> Pollution imposes significant limitations on the recreational and tourist use of waters in many areas of the Maritime Provinces.

Water bodies and beaches within or close to most of the larger communities and some of the smaller communities of all three provinces that were formerly used by local residents for day-to-day water-based recreation activities are no longer used due to pollution, or are threatened by pollution. In effect the frontier of water-based recreation activities has been pushed back by pollution. An indication of the importance of pollution relative to recreational use in the communities embraced by the Study Areas is given by the fact that 33 out of a total of 47, or 70 per cent, reported serious impairment. In New Brunswick 9 out of 10 reported this handicap, in Nova Scotia 16 out of 25 and in Prince Edward Island 8 out of 12.

The destruction and loss of recreational resources and the consequent need to utilize more distant areas may involve substantial time and monetary costs and exert a depressing effect on participation rates. Such losses are particularly significant to residents without the means to travel the extra distances, particularly the elderly and the young. When community beaches and bathing areas are destroyed by pollution there is a demand for artificial swimming pools; the resources destroyed have to be replaced or substitutes provided in some way, possibly involving substantial investments and conflicts in resource use. For example, there may be pressures to utilize water supply reservoirs for recreation, leading to increased waste treatment and purification costs, or to utilize hydroelectric power reservoirs leading to the need for reduced drawdown and a consequent loss of generation. When pollution is considered in this over-all context, it is evident that the cost of pollution cannot be avoided and can be very substantial.

> There is a need for greater assertion by municipal levels of government in the development of recreational facilities.

There is a hierarchy of responsibility for beach and park development ranging from the municipal upward through the provincial to the federal government. Some communities are dependent upon nearby resources over which they have no control. Consciously or subconsciously local governments are relying increasingly upon federal and provincial beach and park develop-

ment to meet their requirements. There are serious dangers in this approach; it is important that all levels of government fulfill their obligations. The specific needs of a community can best be assessed and met by the municipal government.

Wildlife

> The Maritime Provinces support a wide variety of wildlife. Conservation of this valuable resource is essential.

New Brunswick and Nova Scotia support about 12,000 moose and about a quarter of a million deer. Estimates of the population of other species are not available but many species of waterfowl, upland game and furbearers are common. The common species are:

Big Game	Waterfowl	Upland Game and Furbearers
White-tailed deer	Canada goose (locally)	Woodcock
Moose (locally)	Black duck	Wilson's snipe
Bear (locally)	Ring necked duck	Ruffed grouse
	American eider (locally)	Spruce grouse (locally)
	Common merganser	Red Fox
		Wild (bob) cat
		Lynx (locally)
Aquatic Furbearers		Weasel
Beaver		Red squirrel
Muskrat		Skunk (locally)
Mink		Snowshoe hare
Racoon (locally)		Marten (locally)

Wildlife values are complex and comprise commercial, recreational, aesthetic, biological, scientific, social and negative components. It is estimated that direct expenditures by hunters in the Maritime Provinces, in 1966, totalled roughly $12 million. This is a minimum measure since it does not include intangible results.

As urbanization increases, the intangible recreational, aesthetic, biological and social values of wildlife will continue to grow. The wildlife resource is an intrinsic part of the fabric and quality of man's natural environment and there is a growing recognition of the importance of each element of the environment and the interrelationships and interdependencies between them.

> There has been an upsurge in non-hunting wildlife activities (animal and bird watching, photography and study) in recent years. There is little doubt that in the future non-hunting wildlife recreation and aesthetic demands will be very great indeed.

Evidence of this trend is given by the increasing numbers of wildlife parks, conservation and natural history organizations and wildlife associations in the Maritime Provinces and the increasing interest in them. An important component of the appeal of the Maritime Provinces to residents and tourists alike is the availability of an unspoiled natural environment within short distances of urban centres. Preservation of this asset will assume increasing importance in the future.

> Wildlife conservation is dependent on proper management of land and water. Planning at all levels must take adequate account of the wildlife resource and the effects that changes may have.

The presence of wildlife using the water, forests and fields of the Maritime Provinces reflects the quality of the non-urban environment. The availability of good quality water in appropriate quantity and depth is an essential component. All of man's activities have an impact on wildlife. Logging, creating impoundments, building roads, farming, urbanization, to name the more obvious ones, have an effect on the ecological balance, some immediate, such as flooding habitat, and some long term. It is important that the likely effects be understood in the planning stage of any major project.

> Pollution of both water and land is the most serious threat to wildlife in the Maritime Provinces. Research into the effects of pesticides and herbicides, specifically forest-spraying programs, needs to be intensified.

The devastating effects on fish in the 1950's of DDT sprayed in heavy doses over large areas of New Brunswick has already been noted. The effects on wildlife still remain largely unknown. Improved techniques and control have since reduced the apparent effects on fish to negligible proportions but there is evidence that phosphamidon which is now being used along the major watercourses, although not toxic to fish, is causing high bird mortality. Lack of control over oil and other waste discharges and improper land-use resulting in increased soil erosion and siltation are causes for concern. The clear-cutting of forests in headwater areas can have serious consequences for the wildlife resource; it is not at present effectively controlled in the Maritime Provinces. Existing land-use and management practices place limitations on access to areas containing valuable wildlife resources. The increasing demands for wildlife will necessitate an examination of present practices so that multiple use can be encouraged wherever possible and conflicts minimized in the future.

Agriculture

> Agriculture in the Maritime Provinces has entered a period of adjustment. The future of the industry depends, in large measure, on its ability to make necessary changes and adjustments and take advantage of modern technology.

In terms of the number of farms, employment, and land in farms, agriculture has been a declining industry in the Maritime Provinces for many years. The industry has not kept pace with the technological revolution that has taken place and has not maintained its share of expanding domestic and world markets.

There are signs, however, that a more viable industry may be emerging. Commercial farming is on the increase especially in Prince Edward Island and many large-scale progressive enterprises have been established in recent years.

> The future of the industry appears to lie in large-scale enterprises concentrating on intensive specialty crops such as fruits, vegetables, potatoes and possibly tobacco in certain areas. These are the crops for which supplemental irrigation is most likely to be economic.

There are other possibilities, of course. The development of grains suitable for the cool humid conditions in the Maritime Provinces is one. New market opportunities may be another. Aggressive action is needed to capture markets for ag-

ricultural products and tailor production to these markets. The availability of land does not seem to pose a limitation but this is only one input, and under today's competitive conditions, other inputs such as technology and capital are equally if not more important.

> Research into crop response to supplemental irrigation in the Maritime Provinces is urgently needed.

Little research has been undertaken in the region. Research under similar conditions elsewhere suggests that the responses may be large. Moreover, marketing studies are required to project the probable demand for each of the various crops now grown in the Maritime Provinces and crops that have good potential. A land classification according to suitability for irrigation in greater detail than is now available is also required.

> Irrigated acreages in 1966 are estimated to have been:

	Irrigated Acreage
New Brunswick	770
Nova Scotia	3,500
Prince Edward Isl.	Less than 200
	Total about 4,500

Supplemental irrigation is already well established in Nova Scotia. In New Brunswick it is only beginning to take hold and in Prince Edward Island it is still very much in its infancy.

> Prediction of irrigated acreages in the future is difficult and fraught with uncertainties, due to the absence of historical trends, a detailed market analysis and other information.

For the purposes of this study a range has been developed based on judgments and discussions with provincial agriculturalists. The ranges assumed are as follows:

	Irrigated Acreage in 1981		
	High	Low	Median
New Brunswick	40,000	1,100	21,000
Nova Scotia	50,000	5,100	28,000
Prince Edward Island	30,000	1,000	16,000
Total	120,000	7,200	65,000

Distribution of the irrigated acreage is subject to even more uncertainty but it is thought that in New Brunswick 73 per cent will take place in the Saint John River Valley with smaller amounts in the Petitcodiac (7 per cent) and Richibucto (6 per cent) River Valleys. In Nova Scotia the bulk will occur in the Annapolis-Cornwallis Valley (76 per cent) and the remainder will probably take place in the River Philip (14 per cent) and Shubenacadie-Stewiacke (10 per cent) River Valleys. The distribution by county in Prince Edward Island is assumed to be Kings 35 per cent, Queens 35 per cent and Prince 30 per cent.

Irrigation and livestock water demands in each of the provinces in 1981 are estimated in Table 1-4.

TABLE 1-4

Estimated Irrigation Demand,
Maritime Provinces, 1981

Province	Irrigation Demand						Live-stock Demand
	High	Low	Median	High	Low	Median	
	20% Risk Level			5% Risk Level			
	acre-ft/year						
New Brunswick	6,000	160	3,170	7,840	270	5,180	3,350
Nova Scotia	15,250	1,540	8,540	20,890	2,130	11,700	2,300
Prince Edward Is.	11,460	390	6,140	15,330	510	8,180	3,660
Maritime Provinces	32,720	2,090	17,850	44,060	2,910	25,060	9,310

Analysis has shown that there are sufficient supplies of adequate quality surface and/or ground water to meet supplemental irrigation demands in 1981 in all basins. Major storage development could be necessary in the Annapolis Valley.

This conclusion must be qualified by emphasizing that it refers to the aggregate only. The areal distribution of farms using irrigation is an important factor and, in areas of high intensity, local shortages may be created particularly if ground water is used. On the other hand a high intensity of farms using supplemental irrigation enhances the economic feasibility of developing and distributing a surface source. The relative abundance of the water resources of the Maritime

Provinces may well represent a significant opportunity to the agricultural industry in areas where supplemental irrigation is demonstrated to give economic returns.

> Soil erosion is a significant problem in the Maritime Provinces from the standpoints of both agriculture and the quality of the water resources. Recent efforts to find a practical solution should be supported and, if necessary, intensified.

The areas seriously affected are the potato-growing districts of New Brunswick, mainly Victoria and Carleton Counties. Measurements have indicated that soil loss may be several times greater than commonly-accepted allowable amounts. Other areas of significant erosion have been reported in all three provinces.

Eroded soil can ultimately find its way into major watercourses. High turbidity at times of heavy rain has been noted in many streams draining farmlands throughout the provinces. In addition to the impairment of water quality there may also be siltation of estuaries (e.g., Saint John, Richibucto) and oyster beds (Malpeque). Siltation of estuaries is likely to be a complex phenomenon involving littoral drift and oceanographic effects as well as the silt derived from land erosion, and further study is recommended, particularly in Malpeque Bay.

Drainage is one of the major factors limiting crop production in many areas. In these areas the costs and benefits of improving drainage should be determined. The importance of adequate drainage as a prerequisite to supplemental irrigation must be borne in mind.

Flooding is a problem affecting agricultural activities in certain areas notably in the Maugerville area of the lower Saint John River and in the Kennebacasis River Valley. In Nova Scotia overbank flooding is common in the River Philip Valley and in a number of areas in the Shubenacadie-Stewiacke Basin.

Power

> The development of hydroelectric power has played an important role in the history and growth of New Brunswick and Nova Scotia. Virtually all of the competitive sites have now been exploited.

The Maritime Provinces were not endowed as favourably with hydroelectric resources as were other parts of the nation, notably those embracing the Canadian Shield and Cordilleran Mountains. Prince Edward Island has none of any significance. There are, however, substantial resources in the two larger provinces and most of these have now been developed.

> Increased demands for energy until 1981 will be met almost entirely by thermal generating facilities. Later this century, nuclear and possibly tidal generation may enter the scene.

Expansion of the transmission interties that New Brunswick has with Nova Scotia, Québec and Maine and the establishment of a link with Prince Edward Island, may alter the development patterns of the interconnected systems. Consolidation of generating facilities into very large units and plants, with attendant economies, would be encouraged.

Further hydroelectric development is likely to be limited to the installation of additional peaking units at existing plants, development of a peaking plant at Wreck Cove, Nova Scotia, and possibly the development of pumped storage. A number of sites with relatively small conventional hydroelectric potential were examined during the course of the study. None was found to be competitive with alternative thermal generation. Trends in the economics of choice between alternative generating facilities suggest that there is little likelihood of sites with small hydroelectric potential being developed in the future, unless other benefits are substantial.

Although no conventional hydroelectric sites worthy of further investigations were revealed during the study, a number of pumped-storage sites were identified. One is located on the Nerepis River near Saint John, two are in the Annapolis Basin and three are located in the northern part of the Cape Breton Island. Detailed studies would be required to ascertain whether pumped-storage developments can be utilized advantageously in the near or distant future but the trend toward greater interconnection of systems, the rapidly increasing proportion of thermal generation and possibilities of nuclear and tidal power generation later this century suggest that further studies are warranted.

> Thermal generating plants and nuclear plants should be located on tidewater to minimize thermal and air pollution effects, and it is assumed that they will be.

Most thermal plants have been located on tidewater in the past, but not all. With improved transmission techniques and bearing in mind that no point in the Maritime Provinces is more than 90 miles from the coast, the reasons to locate such facilities inland are few. Oyster farming could possibly benefit from the waste heat in suitable estuaries and this possibility should be borne in mind in planning new plants.

> Hydroelectric developments usually offer important secondary benefits. In the Maritime Provinces flow regulation and the use of the impoundments for recreational purposes are particularly significant.

Recreational use of the storages and headponds has, to date, been quite limited due to lack of public demand. The opportunity does exist nevertheless and should not be overlooked.

> Hydroelectric development has frequently conflicted with the conservation of anadromous fish.

The conflict with the fishery has been described briefly. Modern technology has permitted this conflict to be minimized at recent developments. A problem which may assume increasing importance in the future is the sudden wide fluctuations in discharge associated with peak-load operation which can create difficulties downstream. This will have to be borne in mind when considering future installation of peaking units at existing hydroelectric plants.

Transportation

> Commercial navigation in the inland waters of the Maritime Provinces is a very minor activity and is expected to remain so. There has been a major upsurge in recreational boating in recent years and this activity is now widespread in the large rivers, lakes, estuaries and harbours of the region.

There are concentrations of recreational boating on the lower reaches of the Saint John River, Grand Lake and along the Northumberland Strait shore in New Brunswick. In Nova Scotia the most important concentrations are in Halifax and Sydney harbours, the Bras d'Or Lakes, around the Digby area and along the northern shore between Tidnish and New Glasgow. Charlottetown and Summerside harbours are important centres in Prince Edward Island.

There is every reason to believe that the upsurge in recreational boating will continue and probably accelerate.

The Maritime Provinces are endowed with excellent opportunities for recreational boating whether it be yachting, canoeing or motor boating. The Bras d'Or Lakes stand out, particularly from the yachting viewpoint, as a resource with immense potential. With increased leisure time and disposable income, residents of the region will turn increasingly to boating and water sports for recreation. An increase in boating activities by non-residents can also be anticipated. Moreover, further cottage development will tend to generate increased pleasure boating.

Pollution may have already inhibited pleasure-boating activity in certain areas and most certainly will tend to in the future if not abated.

Pleasure boating is sensitive to visible pollution. Bacterial pollution can constitute a hazard to enthusiasts in canoes and centre-board yachts, which are liable to capsize. Measures to reduce pollution will enhance efforts to achieve maximum benefits from the recreational boating potential of the water resources.

Log driving is a declining activity in the Maritime Provinces and this trend is expected to continue. Many rivers and estuaries are still used for log storage. This use will undoubtedly continue into the foreseeable future.

The only rivers still being driven to a significant extent are the Restigouche, Upsalguitch, Benjamin, Tobique and Nashwaak, all of which are in New Brunswick.

The decline in log driving is due to unfavourable costs when compared with trucking with modern equipment. If the indirect costs of log driving were included in the comparison, the trend to trucking would be reinforced. Log driving creates physical pollution in the form of bark, pieces of wood, deadheads and stray logs, and chemical pollution due to decomposition of detritus, and can physically scour and alter the stream bed. The accumulations of bark, wood and other debris on the beds of rivers used for log driving can impair water quality long after the driving has ceased.

An important legacy of log driving in the Maritime Provinces is the large number of small dams remaining on many of the rivers and tributaries.

During the course of the study, it was observed that almost every significant river or tributary possesses small dams associated with log driving or sawmill operations. Many are in a state of disrepair and many are no longer used. Although many are probably of no consequence, it is clear that some represent barriers to anadromous fish and some inhibit recreational use of the stream. It has not been possible to assess this situation in detail but there is little doubt that an inventory should be taken in each province with a view to restoring structures that can be gainfully employed and removing those that no longer serve a useful purpose and are inhibiting beneficial uses. An important start in this direction was made by the New Brunswick Department of Natural Resources. The New Brunswick survey identified 216 dams in the major river basins of the province, of which 35 are in a bad state of repair, 35 are no longer used for their original purpose and 23 are both in a bad state of repair and no longer used.

Flooding

Flooding is not a major problem in the Maritime Provinces but there are a number of places where flooding causes significant hardships.

Flooding in the spring is prevalent in the Saint John River Basin between Fredericton and Hampstead (particularly in the Maugerville area) and in the Kennebecasis Valley. The 1961 flood of the Saint John was one of the highest on record and resulted in fairly extensive damage, particularly in York County. Interval land along the Nashwaak, Petitcodiac and probably other streams in New Brunswick is liable to flooding each spring, but apparently the damage is slight.

In Nova Scotia, the watersheds tend to be smaller and steeper. Flooding of the better-quality agricultural land along the banks of several rivers is common. The lower reaches of the Philip, Stewiacke, Salmon-North and LaHave Rivers are particularly susceptible. The worst floods are frequently caused by a combination of high runoff, high tides and ice jams at tidewater. Generally it appears that the value of the damage sustained is not great but there can be considerable inconvenience and hardship nonetheless.

Flooding does not seem to pose significant problems in Prince Edward Island.

There is a lack of data on flooding and the cost of flood damage in the Maritime Provinces. Possibly this reflects the relatively minor significance of the problem in a regional sense. However, flooding is definitely causing difficulties and hardships in certain areas, and the magnitude of the problem should be better defined.

Waste Disposal

A major proportion of the wastes generated by the population of the Maritime Provinces is discharged into nearby streams or bodies of water without treatment. Important progress has been made in recent years in the construction of treatment works but much remains to be done.

During the course of the data collection surveys all communities having a population of 1,000 or greater, plus other small communities within the Study Areas and River Basins were covered. Table 1-5 has been derived from the results of these surveys and includes treatment works in operation in early 1967 only. A number have been commissioned since that time.

TABLE 1-5

Municipal Waste Disposal, Maritime Provinces, 1966

	New Brunswick		Nova Scotia		Prince Edward Island		Maritime Provinces	
	000	%	000	%	000	%	000	%
Population known to be served by public sewers with treatment facilities	63	10.2	10	1.3	9	8.3	82	5.5
Primary*	4	0.6	0	0.0	1	0.9	5	0.3
Secondary‡	59	9.6	10	1.3	8	7.4	77	5.2
Population known to be served by public sewers but without treatment facilities	231	37.5	370	48.9	31	28.7	632	42.7
Remaining population#	323	52.3	376	49.8	68	63.0	767	51.8
Total population	617	100.0	756	100.0	108	100.0	1,481	100.0

* Primary treatment is essentially the removal of solids.

‡ Secondary treatments involves bacteriological processes.

\# It may be assumed that a large proportion of the remaining population is located in rural communities and is connected to septic tanks and cesspools.

The tabulated data must be qualified because not every community was surveyed. Although it is reasonable to assume that most of the communities and virtually all of the population having sewer systems were included, the values shown may have been slightly underestimated.

The proportion of the population known to be served by sewers with treatment is still relatively small, especially in Nova Scotia. It must be stressed, however, that virtually all of the treatment works have been constructed in the last ten years and most in the last five years. Studies of sewage disposal systems are being intensified with provincial government persuasion and financial assistance. It is a fact, however, that there has been far more progress toward sewage treatment in the smaller communities than in the major population centres, where, in quantity terms, most of the wastes are generated. This situation may now be beginning to change, as evidenced by the decision of the City of Fredericton to construct a comprehensive treatment works and the decision of the City of Halifax to undertake a major study of the problem. Needless to say, the over-all impression given by the tabulated data will change markedly as progress in the larger centres is made.

In general, the population not connected to sewer systems uses septic tanks and cesspools. In a number of areas, septic tanks and cesspools function inadequately and nearby wells and streams are being contaminated as a result.

> The situation with regard to industrial wastes is similar to that of domestic wastes. Important progress is being made toward the installation of treatment facilities and the application of other techniques such as process changes to reduce the quantities of wastes discharged, but much remains to be done.

The data collection surveys isolated manufacturing industries using 5,000 gpd or 375,000 gal per quarter and considered these to be major water-using industries. Most of the larger manufacturing industries discharging significant waste loads fell into this category. Based on the information obtained, the numbers of establishments with waste treatment facilities are tabulated below (Table 1-6).

The tabulated data do not include plants which are now undertaking the construction of treatment works or making process changes to reduce waste loads. In New Brunswick a large pulp mill at Edmundston is effecting major changes that will greatly reduce its waste load by 1971-72, and a major food-processing establishment at Florenceville is introducing treatment to substantially reduce the waste load. A new pulp mill at Nackawic which is scheduled to become operational in 1970 will employ modern process and treatment technology to minimize

TABLE 1-6

Number of Industrial Establishments Known to Have Waste Treatment, Maritime Provinces, 1967

Industry Type	New Brunswick		Nova Scotia		Prince Edward Island		Maritime Provinces	
	No. of Estab-lishments	No. Known to Have Waste Treatment	No. of Estab-lishments	No. Known to Have Waste Treatment	No. of Estab-lishments	No. Known to Have Waste Treatment	No. of Estab-lishments	No. Known to Have Waste Treatment
Pulp and Paper	9	3	5	1	0	0	14	4
Food Processing	25	1	33	6	20	3	78	10
Fish Processing	15	6	33	3	8	0	56	9
Breweries	2	0	3	1	0	0	5	1
Others	15	8	16	9	0	0	31	17
Total	66	18	90	20	28	3	184	41

its waste discharges. Important steps are also being taken in Nova Scotia and Prince Edward Island.

On the other hand, it should be mentioned that some of the industrial treatment facilities included in the tabulation involve minimal treatment and some are at present overloaded. Many of the smaller establishments discharge their wastes to municipal sewers so that the responsibility for treatment and disposal is taken over by the municipality. Nevertheless, the tabulation does give an indication of the progress to date and the magnitude of the industrial waste disposal problem which remains.

As with domestic wastes, most of the industrial waste treatment facilities have been introduced in the last few years and this must be borne in mind when reviewing these statistics.

> The results of present waste disposal practices in the three Maritime Provinces are shown on Maps 3, 4 and 5. Many of the major rivers are polluted and pollution of harbours, estuaries and inshore waters is widespread.

The maps are based on subjective judgments of the condition of the waters. Mining, forest spraying, log driving, soil erosion, etc. contribute to pollution but the primary cause by far is waste disposal. Introduction of treatment plants either under construction or firmly committed will improve the situation considerably, but even after these go into operation, the aggregate level of pollution will not be greatly diminished. This is not to say that substantial progress has not been made in recent years; it has, but the backlog is great. Because of the vast quantities of solid wastes discharged over the years, recovery may take a long time in many of the larger rivers.

> The cost of the treatment plant is only a part, often a relatively small part, of the total cost of constructing comprehensive sewage disposal and treatment systems for existing communities and industries.

The problem in many communities is not so much the cost of the treatment plant as it is the cost of conveying wastes to it. Large communities adjacent to major bodies of water invariably have a multiplicity of sewage outfalls. In most communities the existing sewer system is combined, i.e., carries stormwater as well as sewage. In some parts of the Maritime Provinces, particularly Nova Scotia, bedrock tends to be close to the ground surface and the cost of installing sewers can be extremely high. The prevalence of low-density residential areas and strip development poses additional prob-

lems. It has been estimated that in Nova Scotia the cost of sewage collection averages three times the cost of constructing treatment plants and that in extreme cases the ratio can be as high as eight to one. To combat the high costs the Nova Scotia Water Resources Commission has undertaken research into treatment units suitable for installation at individual outfalls on the ocean front.

A similar problem is encountered with existing industries, particularly older pulp and paper mills. Whereas the drain system and water intake of a new mill can be designed so that total water utilization costs are minimized, to achieve the same result in an existing mill may necessitate reworking the drain system and making other in-plant modifications at much greater over-all cost.

PRIORITIES

In the preceding sections numerous conclusions have been drawn regarding the water resources of the Maritime Provinces and the demands, both present and future, imposed on the resource. Two issues deserve particular emphasis. The first is pollution. Pollution is a recurring issue throughout the preceding sections and indeed throughout the whole study. Pollution, which can be defined as an impairment of water quality which inhibits or precludes beneficial use, is a widespread problem, despite the important progress in recent years toward control and abatement. The disposal of wastes with inadequate or no treatment is the primary cause. Pollution in the Maritime Provinces has not reached the proportions found in some other parts of the North American continent, but this does not justify complacency. The quality of the natural environment is one of the region's most important assets and one which will assume increasing importance in the future.

An estimate of the damage costs (benefits foregone) of pollution cannot be made without much more detailed study, but there is evidence that it may be substantial. (At the 1966 conference on "Pollution and Our Environment" in Montreal, it was suggested that cost of pollution of air, water and soil to each person in Canada is about $72 per year.) Beyond the identifiable costs are the intangible costs to society of the devaluation of the environment - costs which are reflected by the growing demands of society for clean water, air and more enlightened land use. The cost of intensifying pollution-control and abatement measures will be high and inevitably there will be competition with other programs, such as education and health, for scarce public funds. Moreover, the costs may exceed the identifiable benefits in the short term. In the long term, however, the benefits will be very great in terms of the growth and welfare of the region and will, it is suggested, fully justify the cost. Because pollution control and abatement must take their place alongside other much-needed programs, the achievement of

objectives will take time. It is essential nevertheless to establish an ultimate goal and set bench marks that will measure the rate of progress toward that goal.

The appropriate ultimate goal in the Maritime Provinces is believed to be the restoration and maintenance of the water resource suitable for the widest range of beneficial uses. Interim objectives and priorities will have to be established with a view to maximizing the effectiveness of investments year by year. Of great importance will be the formulation of long-range policies and plans which will lead progressively toward the ultimate goal and guide the measures introduced. It is concluded that pollution control and abatement should receive top priority in the regional sense.

The second issue of a regional nature which warrants emphasis is related to the management, planning and quality of service of the public water utilities in the Maritime Provinces.

In general, it has been found that the problems concerning utility water supplies are better defined than the problems concerning pollution and consequently studies of pollution problems should occupy greater attention in the future. The need for study of the management and planning issues which have been exposed is also prominent in the regional sense.

One general observation regarding studies of water resources issues should be made. In several instances, it has been found that studies have been too narrow in scope and as a result did not permit an adequate assessment of all relevant alternatives and all implications of specific courses of action. Although it is not always necessary to adopt a comprehensive approach it can be essential in many situations. Whenever a study is initiated the need for a comprehensive approach should be assessed.

Study Areas

A total of 36 Study Areas, defined as centres of population and economic activity, was selected for analysis of demand and supply. Although not treated in the same depth, Shippegan and Caraquet have been added bringing the total to 38. The Study Areas are shown on Map 2.

The Areas are listed below, generally in the order of the impact of the water resource issues on the communities concerned.

Summerside

Major salt-water intrusion occurs at many of the municipal and industrial wells in the town of Summerside. Overpumping is evident. Immediate action is needed to eliminate the

problem. Domestic and/or industrial wastes are polluting both Summerside Harbour and Malpeque Bay. Oyster harvesting without cleansing has already been precluded in Summerside Harbour and further deterioration could impair similar use in contiguous waters as well as the recreational use of these waters. Malpeque Bay is the prime oyster harvesting area in Prince Edward Island and measures should be taken to maintain adequate water quality and assess the problem of siltation.

Halifax-Dartmouth

The main issues are the selection of the source of water supply to meet the future demands of Halifax and the question of urban and industrial development on presently used watersheds. The economics of alternative courses of action point clearly to the selection of a staged supply from Lake Major for expansion of the Halifax system with the retention of the Long-Chain Lake Watersheds unless revenues from their release amount to $5 million. The introduction of a supply from Lake Major, involving joint development with Dartmouth, may pose administrative difficulties which should be the subject of study and negotiation. Halifax Harbour and Bedford Basin are polluted by domestic and industrial waste discharges. While the discharges from the Halifax side are the subject of a study now being initiated, a regional examination of this problem will be necessary.

Shippegan

The water supply situation in the town of Shippegan is serious. Salt-water intrusion has become increasingly more severe in recent years and a temporary system had to be used in 1968 to meet the demand. Water demands are predicted to increase in 1969 and, even with the temporary system, cannot be met. Additional sources are needed by April 1, 1969. Pollution of the harbour and inshore waters is also causing difficulties.

New Glasgow

The principal issue in this Study Area is the need to co-ordinate the water supply systems of the towns of New Glasgow, Stellarton, Westville, and Trenton to achieve maximum efficiency and economy when upgrading and expanding the supply facilities. Pollution is a major problem in the East River below Stellarton and along the nearby beaches on Northumberland Strait.

Shelburne

The main issue in Shelburne is the need to upgrade domestic and industrial water supplies. There is at present no public supply system. Comprehensive engineering studies have been conducted into the various sources available but the best

course of action may depend on the likelihood of Shelburne becoming a growth pole for the fish-processing and other marine-oriented industries in southwestern Nova Scotia. Pollution of the harbour is not regarded as serious at present but could become so unless treatment facilities are installed.

Cape Sable Island

The key issue here is the need to upgrade fresh-water supplies to the fish-processing plants. Engineering studies have been carried out but choice of the best course of action on the Island, and in the area as a whole, may be influenced by the role foreseen for the Study Area in the expansion and consolidation of the fish-processing industry in southwestern Nova Scotia.

Charlottetown

The need for an additional source of water supply, as well as an improvement of the existing supply facilities, is the prime problem requiring both investigation and action. The proximity of the three communities comprising the Study Area enhances the potential benefits from interconnection of supply facilities. Domestic and industrial waste discharges are posing a threat to the fisheries and recreational resources of the waters surrounding the Study Area.

Sydney

Undersized transmission and distribution mains, which - with age - have become further restricted in carrying capacity, have led to inadequate service and a lack of adequate fire protection in many areas. Major expansion of water supply facilities is necessary for the Point Edward Industrial Park and possibly for New Waterford and Glace Bay. Pollution is widespread in the Study Area; Sydney Harbour, in particular, is seriously polluted. The importance and complexity of the area necessitates that high priority be given to planning and management issues and to pollution problems.

Campbellton (Including Atholville)

The existing Campbellton source is capable of meeting the forecast demands of the entire Study Area. It is recommended that the possibility of Atholville purchasing its future requirements from Campbellton and sharing in the development of that source be investigated. Minor modifications to Campbellton's distribution system are required and the problem of untreated waste disposal into the Restigouche River requires study.

Truro

One of the main priorities in the Truro area is the emerging need for a major expansion of the water supply facilities. Significant problems in the area are flooding and, to a lesser extent, pollution and a lack of fresh-water-based recreational opportunities. In order to alleviate these problems, a comprehensive benefit/cost analysis of providing major storage on the Salmon River should be undertaken.

Arichat

The need for an alternative source of fresh-water supply to the fish-processing industries is the key issue. Also, the increasing level of pollution in Petit-de-Grat Inlet could bring about the need for new sea-water intakes to these industries; the problems need to be studied in more detail. St. Peters is well located to become a focus for water-based recreational activities on the Bras d'Or Lakes.

Bathurst

The principal issue in the Bathurst area is the emerging need to expand the water supply system and select a new source of supply. The possibility of using the Nepisiguit River should be investigated. A joint development between the City of Bathurst and Consolidated Bathurst Co. Ltd. is a further possibility. Pollution in Bathurst Harbour inhibits recreational and possibly other uses.

Dalhousie

Management of complex water supply arrangements is the principal issue in Dalhousie. The establishment of a provincially-owned utility to own and operate the supply facilities should be considered. The town has a very high per-capita demand caused by excessive leakage in the distribution systems.

Lockeport

Economic development in the area is hampered by a lack of fresh water and the pollution of inshore waters. Engineering studies into the supply of fresh water have been conducted and early development of the recommended source is essential for the welfare of the community and its fish-processing industries. Investigation of the problems associated with domestic and industrial waste disposal is recommended.

Windsor

Upgrading and expansion of transmission and distribution systems are the main problems in this Study Area, notably in Windsor. Major opportunities for water supply and recreation will be presented by the new reservoir upstream of the Windsor-Falmouth causeway. Probable increases in siltation and pollution downstream of Windsor require evaluation.

Newcastle

The main issue in the Newcastle area is pollution in the Miramichi River which is affecting recreation and posing a threat to fisheries. The need for future development of industrial water supplies, and salt-water intrusion into certain wells, are also significant.

Saint John

Pollution is the main issue in the Saint John Study Area. Another issue is the possible need to co-ordinate supplies to the proposed deepwater port at Lorneville with the city's system. Siltation, conflicts in watershed usage and future development of water supplies are also important.

Moncton

Planning and management of the extensive resources available to meet future demands are important issues in the Moncton Study Area. The new reservoir upstream of the causeway offers significant opportunities for water supply and recreation provided that upstream pollution is abated. Immediately downstream of the causeway, pollution and siltation are increasing and posing problems.

Other Study Areas

The impact of water resources issues on the welfare and growth of the remaining Study Areas is judged to be of lesser magnitude. These Areas are listed below:

Yarmouth
Bridgewater
Fredericton
Lunenburg
Montague
Tignish
Caraquet
Edmundston
Strait of Canso

O'Leary
Riverport
Souris
Belledune
Mount Stewart
Amherst
North Rustico
Borden
Georgetown
Alberton
Morell

River Basins

A total of 22 River Basins was selected for analysis of demand and supply in somewhat less detail than the Study Areas. The River Basins and their boundaries are shown in Map 1.

The River Basins are listed below, generally in the order of magnitude of the problems and opportunities, related to the water resource, which have been exposed.

Saint John

Pollution and its effects are the key issues in the Saint John River Basin. In addition to the conflicts between pollution and the opportunities for increased use of the river for recreation, water supply and other developments, there is a conflict between hydroelectric development and anadromous fish runs. Possibilities for economic development of storage and flow regulation in New Brunswick are limited but the need is great. Development of the Rankin Rapids or its alternative the Big Rapids - Lincoln School storage and power project in Maine would produce important benefits in New Brunswick. A possible pumped-storage site has been identified. Erosion control is believed to be particularly urgent in the upper portions of the Basin.

Miramichi

The main problem is the conservation of water quality to maintain the unique fisheries of the Basin while exploiting its mineral, forest and recreational resources without altering the wilderness character of the watershed. The several aspects of this problem include the conflicts between estuarial pollution and fisheries, and between forest spraying and wildlife (including fisheries). The allocative procedures used for sport fisheries and the resulting effect on the optimal use of the recreational resources need more detailed study. The water resources are adequate to meet the relatively modest demands of population, industry, power, transportation and agriculture.

Restigouche

Estuarial pollution by population and industry is posing a threat to the outstanding Atlantic salmon sport fishery of the river and hence the recreational potential. The problem needs critical appraisal. Mineral prospects exist in the Basin; their development, without adequate control of waste discharges, could result in similar problems to those encountered in the Miramichi and Nepisiguit River Basins.

Cornwallis

Pollution and its effects are the main issues at present. Agriculture forms the basis of the economy of the Basin and supplemental irrigation on a large scale may take place. The suitability of soils in the Basin for irrigation should be assessed. The available water resources of the Basin as a whole should be adequate in the study period but major development could be required. The possibility of diverting water from Aylesford and Gaspereau Lakes has been identified but would conflict with the present use or the Gaspereau River for hydroelectric power generation.

Nepisiguit

The Nepisiguit River Basin has substantial mineral and forest resources. While it supports lesser fisheries than its neighbouring basins, the maintenance of adequate water quality to preserve a suitable habitat for wildlife and aquatic life is important. The main sources of pollution at present are the population and the pulp mill located at the mouth of the river. There, waste discharges inhibit recreation and may be detrimental to fisheries. The possibility of opening the upper reaches of the river to Atlantic salmon is under consideration. The water demands of industry and power are significant in relation to the available supply.

Annapolis

As with the Cornwallis River Basin, pollution and its effects are the main issues. Again agriculture forms the basis of the economy of the Basin and supplemental irrigation on a large scale may take place. The suitability of soils in the Basin needs to be assessed. The water resources available in the Basin as a whole appear to be adequate. Two pumped-storage hydroelectric sites have been identified and each appears to possess a potential for development.

Bras d'Or Lakes

The Bras d'Or Lakes are judged to hold great potential for water-based recreation and tourism. Efforts to exploit this potential and to ensure optimum development should be given high priority. Pockets of pollution have been reported, particularly at Baddeck, and although minor in extent, should be abated so as not to jeopardize the potential of the lakes in any way. A pumped-storage site has been identified on the Middle River.

St. Croix

Pollution is the main issue in the St. Croix River Basin. Despite the introduction of a number of measures to abate pollution, it is not clear whether or not one of the prime objectives, namely the restoration of anadromous fish runs, can be met. It is possible that, in additon to treatment of the sources of pollution, efforts to clean up the existing physical degradation will be required. Studies should be undertaken to find alternative methods to deal with the bottom sediments at less cost than previous proposals. The lakeland complex of the upper reaches is believed to hold a good potential for increased water-based recreational activities.

LaHave

Pollution, flooding, opportunities for storage development and flow regulation, and opportunities for water-based recreation are the main issues. Pollution abatement measures currently being implemented in Bridgewater will go a long way toward solving the problem but waste discharges emanating upstream leave cause for concern. The opportunities for low-cost flow regulation of the river are good. The condition and usefulness of many small dams in the Basin, which may inhibit anadromous fish runs and recreational uses, should be investigated.

Salmon-North

Flooding, and to a lesser extent, pollution and a lack of fresh-water-based recreational opportunities are the principal problems in this Basin. Opportunities for storage development, which could substantially alleviate these problems, are good but appear costly. A comprehensive study of the benefits and costs of storage development should be undertaken.

Petitcodiac

Problems and opportunities in this Basin tend to be oriented toward the recently constructed Moncton causeway reser-

voir. The potential benefits of the causeway for water supply and recreational use are offset by the reduction in tidal displacements which has led to increased siltation and pollution in the vicinity of Moncton. Pollution upstream of the causeway, which could negate some of the benefits, is cause for concern, as is the effect of the causeway on the fisheries resource.

Other River Basins

The over-all degree or scale of the problems and opportunities in the remaining River Basins is judged to be of a lesser magnitude. These Basins are listed below:

Philip
Shubenacadie-Stewiacke
Avon
East, Middle, West (Pictou)
Mersey
Richibucto
Magaguadavic
Medway
Margaree
St. Mary's
Gold

WATER RESOURCES
of the
ATLANTIC PROVINCES

PART TWO

NEWFOUNDLAND AND LABRADOR

PART TWO - NEWFOUNDLAND AND LABRADOR

1. INTRODUCTION

The waters of the Island of Newfoundland and Labrador remind the observer of Wordsworth's rivers and lakes that were "... untouched and unbreathed upon ...", for in this vast province of more than 155,000 square miles, with a little over one-half million residents, much of the water resource has not yet been affected by the activities of man. For centuries, the Newfoundlander confined himself to the rugged, hard, but rewarding life of the sea. However, in recent decades, the progress of the technologically-oriented world has not only created a spectre of economic and geographic isolation for the "livyers" of the seacoasts of Newfoundland, but has also brought an awareness of the necessity for achieving economic and social equality with other regions of North America.

This has led the Newfoundlander to consider the natural wealth of his province and the opportunity it provides for social and economic progress.

The development of the fresh water resources for hydro-electric power, for water supply, and for fisheries and recreation has played a major role in the over-all progress of the land and its people. The recognition by provincial and federal authorities of the importance of the fresh water resources to the future development of the province led to the implementation of this general inventory and preliminary planning study by the Atlantic Development Board. The results of this study show that the province's fresh water resources, if properly managed, will continue to contribute significantly to its economic development.

To provide maximum benefit to present and future generations, it is essential that a comprehensive approach be taken to the development of the province's waters in co-ordination with that of its other resources, and in consideration of economic, administrative, social, and scientific objectives. Emphasis should be placed on planning for long-term development so that problems can be adequately investigated and not met with short-term or ad hoc solutions. In view of the relatively undeveloped state of the resource, early action will see the province take a lead in resource management over many more affluent areas of North America which struggle at great cost to regain a resource that has been degraded to a dangerous level in pursuit of short-sighted goals.

During the course of the study, all available data related to the water resources of the province were brought together. These data are documented in the main report consisting of eight volumes. This summary presents the highlights and principal findings of that report.

The study was initiated to provide information to assist the provincial and federal governments in planning the future utilization of the water resource. It represents the first stage of a detailed program of water resource development planning and embraces the demand, supply and management of the resource throughout the province until 1981 or beyond. The purpose was to identify those areas in the province that now have or will have major water problems or substantial water possibilities and to rank these in order of priority for detailed development planning.

Map 6 is a key reference map of the province outlining the River Basins and Study Areas.

2. HIGHLIGHTS

This study dealt with the water resources of the Province of Newfoundland and Labrador at two levels. First, the general conditions of water availability, supply, and demand were investigated for the Island and for Labrador, as a whole; and second, regional conditions were examined for important river basins and study areas.

While an exhaustive analysis of available information and its further synthesis enabled valid conclusions to be reached for most water availability problems, the situation was not the same with respect to the water supply and demand conditions and related economic data. For these aspects of the study the available information was either too general or fragmentary, or of dubious quality. A serious effort was made to supplement the available data on water demand by means of questionnaires circulated to the more significant water users followed by personal interviews, and in this way some of the gaps were closed.

Map 7 presents a general picture of the water available under average conditions, of the present water use, and of the increase in demand which may be expected if the economic development follows the forecasts outlined in the study.

Natural Water Resources Inventory

The quantity and quality of the naturally available water was studied on the basis of existing data from federal and provincial agencies supplemented by a water quality grab sampling program carried out during the fall of 1967.

Surface Water Quantity

The analysis of the meteorologic and hydrologic data indicated that the Island has an average annual precipitation of 55 inches. With an average annual actual evaporation of 13 inches, the Island's average annual runoff is 42 inches.

The maximum flows are almost invariably the result of combinations of snowmelt and storms, but in some cases maximum levels are caused by ice jams rather than maximum flows.

The Island is covered by a dense network of rivers and lakes, the latter occupying 7.5 per cent of its area. Only three rivers, the Exploits, the Humber, and the Gander have drainage basins larger than 2,000 square miles, and average flows of all Island rivers are therefore relatively small. For the same reason, and because ground-water supplies to the rivers are not very significant, many rivers have extremely low flows or even dry up during periods of extended drought.

The Island can be divided into four principal regions having hydrologic regimes which are shown with their principal characteristics in Table 2-1.

TABLE 2-1

Hydrologic Regions, Newfoundland Island

Hydrologic Region	Avalon and Burin Peninsula	South and East Coast	West Coast and Great Northwest Peninsula	Northeast Coast
Maximum size of drainage basin (sq mi)	101	1,100	3,230‡	4,400
Average runoff (inches)	40 to 60	35 to 50	35 to 70	25 to 30
Average runoff (cfs/sq mi)	3.0 to 4.5	2.6 to 3.7	2.6 to 5.2	1.8 to 2.6
Minimum daily runoff 1/20 years (cfs/sq mi)*	0.0	0.03 to 0.10	0.10 to 0.25	0.05 to 0.10
Maximum daily runoff 1/20 years (cfs/sq mi)*				
a) for basins of 1 to 200 sq mi	30 to 60	25 to 50	70 to 150	30 to 50
b) for largest basin in region	-	18	19	17

* Correction for sampling errors not included.

‡ Next largest basin - 390 square miles.

Correlations for hydrologic characteristics other than average runoff could not be developed for Labrador because of the scarcity of data. However, from the recorded data at seven existing hydrometric stations, it was possible to obtain a general indication of the variation in flow for this area.

Labrador drainage basins are larger than those on the Island. Five rivers have drainage basins of over 4,000 square miles, including the 31,500-square-mile Churchill River Basin. The area of lakes in this portion of Labrador is equivalent to 11.2 per cent of the total area. Because of late snowmelt and large natural storage, the relative variation of the flow for the larger river basins is smaller than that observed in the Island.

Since more detailed data are not available, Labrador has been divided provisionally into two hydrologic regions, the southern and northern, as shown in Table 2-2.

TABLE 2-2

Hydrologic Regions, Labrador

Hydrologic Region	Southern Labrador	Northern Labrador
Maximum size of drainage basin (sq mi)	31,500	4,806
Average runoff (inches)	20 to 25	15 to 25 (est)
Average runoff (cfs/sq mi)	1.5 to 1.8	1.1 to 1.8(est)
Minimum daily runoff 1/20 years (cfs/sq mi)	0.2 (est)	0.0 (est)

The data for the northern Labrador region were estimated from the general climatologic data available and hydrologic records for rivers in adjacent areas with similar characteristics.

Surface Water Quality

From the data available and the estimates, including field checks, it was concluded that the quality of surface water available under natural conditions on the Island can be characterized as follows:

1) The average water temperature ranges from 32 degrees in winter to 60 degrees or more in summer.

2) The turbidity is low, varying mainly between 0 and 5 units, with occasional excessive values being encountered in flood periods, especially in deforested areas.

3) The colour is slightly excessive, varying generally between 10 and 20 units.

4) The dissolved oxygen in rivers in most cases approaches saturation concentration, and in lakes has variable concentration with depth, but generally reflects normal natural conditions.

5) The pH is generally low, being less than 6.5 in most cases, and not exceeding 8.5 in any of the samples.

6) The total hardness is normally low, not exceeding 50 milligrams per litre as $CaCO_3$, except in western regions where the presence of limestone and dolomite increases its value to as high as 120 milligrams per litre.

7) The total dissolved solids content is generally lower than 100 milligrams per litre except in the limited areas where the total hardness is higher than normal.

Some mineralization or eutrophication[1/] of certain inland lakes has occurred possibly through the effect of phosphate and nitrate releases from forest fires. Although this situation is not well documented as yet, visible evidence of its occurrence is being encountered more frequently.

Ground Water

Ground-water availability was studied on the basis of geologic information, data on dug and drilled wells, and data obtained from mines. The information is mainly qualitative, since accurate well-testing data were practically non-existent, particularly in Labrador.

For the Island, data on ground-water quality under natural conditions indicate that the water is generally colourless, with low turbidity, and with a large variation in pH (from 5.2 to 10). The major constituent of dissolved solids is generally calcium, with magnesium predominating in some localities. High salinity which may be related to sea-water intrusion was detected in a series of wells near the seacoast and in some cases relatively far inland.

Withdrawal Water Demand

The largest withdrawal demand for water on the Island is for the pulp and paper industry, and in Labrador it is for the mining industry. Similarly, wastewaters from the pulp and paper industry are most significant for the Island and those from the mining industry in Labrador. This situation is likely to continue throughout the study period to 1981.

The withdrawal demand indicated in Map 7 represents estimated present and forecast intake water demand. It should be noted that most of the withdrawal intake demand near the seacoast represents depletion of the source of supply since the corresponding wastewaters are generally disposed of to the ocean. The same pattern will also be maintained generally throughout the study period.

Most of the withdrawal demands are small and unevenly distributed across the province, reflecting historical development and the character of the resource-oriented economy.

The following comments are pertinent to present and forecast demands:

1/ Enrichment in dissolved nutrients, but with growing seasonal deficiencies in oxygen.

1) Domestic[1] and municipal[2] demand were considered together.

2) The municipal demand includes the commercial and service industry demand related to the smaller industrial establishments normally servicing the local market only.

3) The increase in per-capita demand was related to the increase in income which was estimated on the basis of the economic studies undertaken.

4) The population projection was estimated from past trends and economic factors corresponding to assumptions developed by the Consultant in collaboration with the Board.

5) It was assumed that there will be no increases in the intake capacity of industries unless major expansions take place. This assumption was based on the fact that specific intake water use of existing Newfoundland industries is relatively high at the present time, and the industries should be able to cope with some increased production by using reserve capacity and by increasing efficiency in water use if necessary.

6) In the case of the fish-processing industry, which is one of the most important commodity-producing sectors of the provincial economy, it was assumed that production concentration in a number of large plants (100 million pounds input per year or more) will take place in line with the prevailing trends in the industry.

7) Possible new industries related either to an existing resource (cellulose-based textiles) or to developing industries (chemical and petrochemical related to oil refining) have been considered from the point of view of their water resources implications.

8) The forecast industrial water demands that have already been established for proposed new industries appear to be high in relation to those normally required by the specific industry types.

Non-withdrawal Demand

The principal non-withdrawal demand in the province is for hydroelectric power, and the most widespread demand is for fresh-water fisheries. The demand for log driving is also sig-

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1/ Water used within the home.

2/ Consists of residential, commercial, industrial, and public.

nificant in the Island and will probably increase in some areas of Labrador in the future. The demand for tourism and recreation, although limited, is increasing rapidly and will probably continue to do so over the study period both in the Island and in Labrador. The water demand for wildlife is limited mainly to habitat preservation, although new developments, especially for hydroelectric power, pose special problems.

Hydroelectric Power

At the present time there are 30 hydroelectric plants having a total of 570 Mw installed capacity on the Island[1/], and two plants having a total of 286 Mw installed capacity in Labrador. Out of this total, 17 hydroelectric plants, all on the Island, have installed capacities of less than 5 Mw.

Power shortages have been recorded in a few cases in recent years due to drought conditions, the most important being that at the Deer Lake hydroelectric plant in 1966-67.

The following comments are pertinent to the hydroelectric demand in the province:

1) A number of existing, planned, and potential hydroelectric developments involve diversions from one basin to another, representing a depletion for the diverted rivers.

2) All hydroelectric developments are operated in conjunction with storage, and change the natural regime of the respective rivers. The larger plants are generally operated continuously for production of base energy, thus regulating the flow. The smaller power plants are operated intermittently for peaking and thus increase the natural variability of the flow in most cases.

Fisheries for Fresh-Water-Dependent Species

Fresh-water fisheries exert a considerable demand since virtually all the province's streams are naturally populated by valuable species of fish. In this study it was assumed that the minimum monthly flow occurring naturally with a probability of 30 per cent represents the minimum demand for fisheries. Relationships were developed for assessing the mean monthly flows and their standard deviations, so that the minimum monthly flows with a probability of 30 per cent can be computed for any stream on the Island assuming a normal distribution for the monthly flows. It must be recognized, however, that maintenance of flows near

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1/ The Bay d'Espoir plant at present has an installed capacity of 300 Mw which will be increased to 450 Mw by 1971.

the minimum demand level for long periods due to upstream diversions may adversely affect the fisheries potential of the river. Furthermore, it will be necessary to ensure that any flows to meet the fisheries demand have minimum quality conditions above the tolerance limits for fish.

Log Driving

Log driving has been carried out extensively in the past on both small and large rivers on the Island, although this activity is diminishing with changes in woods operations and increasing mechanization. Generally log driving requires a certain velocity and water depth; and, since in these conditions the flow is heavily dependent on local conditions, it is not possible to estimate the log-driving demand in terms of flow. It may be expected that in the future log driving will concentrate on the larger rivers (Exploits, Humber, and possibly the lower Churchill) which are already or soon will be regulated for hydro power. This will eliminate many log-driving dams which have caused conflicts with other water resource uses in the past; particularly fisheries (because of abrasion by logs of the spawning grounds), and water quality degradation (because of dissolved oxygen reduction through decomposition of bark deposits).

Wildlife, Recreation, and Tourism

In the assessment of water demand in the province for wildlife, it was assumed that, if water quantity and quality conditions satisfied fresh water fisheries requirements, they would generally satisfy wildlife requirements. There should be no significant water resource problems limiting wildlife conservation and development on the Island during the study period. However, in Labrador, wildlife will be affected by the changes in habitat resulting from the development of major storage reservoirs such as in the Churchill River basin.

At the present time the water demand for recreation and tourism is local in character and is limited to a few areas near St. John's, Corner Brook, Gander, Grand Falls, and to various provincial parks. However, this sector of the economy is receiving considerable impetus from the expansion of highways, and is developing rapidly because of a relative decrease in available wilderness areas on the rest of the continent, and to some extent because of increases in population, level of living, and leisure time. Recreation in the province is strongly related to the fresh-water fisheries, and it may be stated that, by satisfying the demand for the latter, the former is generally also satisfied. However, recreation and tourism also benefit from the stability of levels and flows both on rivers and lakes. In the more populated areas such as St. John's, Corner Brook, Gander, Grand Falls, Windsor, and Stephenville, and development areas such as Come by Chance, these level and flow requirements should be considered as part of the demand exerted by recreation and tourism.

Inland Waters Navigation

Water demand for navigation is generally related to requirements for channel depth, width, and maximum velocity, and cannot be expressed in terms of flow requirements. There is no regular commercial inland navigation in the province, and there is practically no likelihood that this will develop in the future. However, there is some navigation related to log driving and recreation and tourism which is adjusting itself to the conditions created by other uses.

"Negative" Water Demand

There are several undesirable effects of water in developed areas which should be remedied, and these were considered a "negative" demand on the resource.

Flooding due to high river stages is a minor problem in Newfoundland. The only recorded case of flooding with significant economic effect on the Island was at the Grand Falls paper mill on the Exploits River and was caused by ice jams.

A few cases were identified where economic losses have occurred due to intentional flooding of storage reservoirs (e.g., Victoria Lake reservoir). Comprehensive long-term planning would have allowed these to be identified earlier and at least partially avoided.

The drainage of bogs and marshes to improve agricultural and forestry conditions is the major "negative" demand in the province. Although there are some 3,900 acres of bogland which have been drained for agricultural purposes, at the present time there are no known drainage developments for forestry purposes. The extent of further drainage development for either agricultural or forestry purposes is difficult to estimate with the data available, but it is not expected to be significant during the forecast period.

A few cases of concentration of runoff with resulting soil erosion in areas subjected to forest fires, improper road design, and forest cutting were identified during the study. These conditions could be reduced by the improved forest management and reforestation practices now being implemented.

Comparison of Water Demand and Supply

An inventory of municipal and industrial water supply and wastewater disposal systems shows the following (1966 figures):

1) Out of 176 communities with populations of 500 or more, 51 have water supply systems and 49 have sewage collection systems.

2) Out of the total 1966 population of some 493,000 in the province, 238,000 persons live in communities having municipal water supply systems; of these, 200,000 are actually serviced by the water supply systems. In addition, 224,000 persons on the Island and 14,000 in Labrador live in communities with sewage systems.

3) Over 90 per cent of the systems use surface water as a source of supply. These are generally gravity systems and, therefore, service pressure is limited in some cases.

4) Supplies from surface water, although generally requiring chlorination, have a better quality than those from ground water. Chlorination equipment in the province is often improperly operated and inadequately maintained.

5) The charges are generally at a flat rate for residential consumers and metered for industrial and commercial consumers. Expenses exceed revenues by various percentages with the difference increasing as community size and system capacity decrease.

6) In small communities, each houseowner normally has developed a dug well for his family's supply. Because of improper well construction and adjacent sewage disposal, many of these wells have water of unsatisfactory quality.

7) All but four inland communities discharge their wastewaters untreated to the nearest receiving body of water and all communities on the seacoast have sewage outfalls directly to the ocean. In many instances wastes from domestic and small commercial and industrial water users which would ordinarily be collected by a municipal sewage system are either discharged to the sea, nearby rivers, or lakes, or to small septic tanks. This results in widespread bacteriological pollution in many settled areas. This situation has been controlled in the newer communities of Labrador by the installation of sewage treatment plants.

The total present water usage by municipalities can be conservatively estimated at 50 million gpd and is probably lower because of low usage in communities without municipal water supply systems. The influence of water withdrawal for municipal uses on the water resources of the province is, therefore, negligible on the regional scale, but may represent significant water resource problems locally.

The inventory for industrial water supply, which covers only those industries having their own water supply systems, shows the following:

1) Total fresh-water intake for industrial uses amounts to about 150 million gpd, excluding the 30,850 gpm used intermittently at the Price (Nfld.) Pulp and Paper Limited mill for wood handling.

2) Smaller industrial users are at a disadvantage from the viewpoint of water supply because of the scale effect of costs. This is most pertinent to the fish-processing industry.

3) Water quality is generally acceptable for existing industrial uses, with some exceptions in the fish-processing industry caused by bacteriologic pollution.

4) Sea water is normally employed at fish-processing plants as a coolant for the refrigeration compressors and in several cases for fluming. The use of sea water in the fish-processing industry raises problems related to the contamination of the sea water in the intake area by municipal or industrial wastes, including those from the fish-processing plant itself.

5) The disposal of wastes by industry is generally to the nearest receiving water body, or the ocean, without treatment, except for the mining industry which generally impounds the wastes (tailings) before disposal.

For the future, the potential water supply on the Island and in Labrador is sufficient to service substantial concentrations of population and industry. However, the minimum flows in many of the Island's rivers are so low as to require storage and/or diversion to support a significant demand.

Fortunately, due to the topography and hydrographic network of the Island, there are numerous possibilities for storage and diversion in most of the basins and these have been studied for the more critical areas of development. Development of storages or diversions should not proceed, however, without considering methods of overcoming the conflicts in use which they may create.

In Labrador, the natural conditions are such that the minimum flows of many of the rivers could sustain significant increases in demand without storage or diversion.

Generally, throughout the province, the water quality is satisfactory for most uses. Industries and commercial activities whose products are sensitive to the colour of intake water (fine paper, laundries) will require that this constituent be reduced, and in all boiler applications corrosion control as well as the control of total solids will be necessary. Municipal treatment, except for chlorination and occasional pH control, should not be necessary over the study period (to 1981). Iron and manganese removal through chemical precipitation and filtration may be required in some instances, especially in relation to ground water.

The opportunity to store fresh water in estuaries to meet large demands for fresh water at the seacoast exists in many areas on the Island and in Labrador. Possibilities of estuarine storage at Come by Chance and Stephenville were examined in view of the large industrial complexes proposed for these areas. These possibilities do not appear to offer significant cost advantages over the proposed fresh water supplies, and represent a potential problem with respect to water quality.

Although disposal of liquid wastes to the sea can be efficiently carried out through proper diffusion and dispersion, appropriate oceanographic studies should be carried out to devise the optimum scheme considering all local shore uses (including in some areas the potential for the future harvesting of shellfish).

The use of desalinated sea water as a substitute for fresh water cannot be considered as a practical alternative in the province during the study period in view of its relatively high cost.

Management of the available supply should permit virtually all demands in the province to be met without undue difficulty and it is not considered that schemes for artificially increasing the available water, such as by evaporation control or weather modification, would have general application through the study period. However, hydrologic forecasting in relation to water management could be an important consideration in the operation of water resource facilities throughout the province to permit optimization of the supply.

In the main study which is summarized here, cost estimates have been prepared for various water resources schemes whose implementation through the study period should be considered. They represent projects for municipal and industrial water supply, for municipal and industrial wastewater treatment, and for hydroelectric power development.

3. PRINCIPAL FINDINGS

Policy, Management and Legislation

In the Province of Newfoundland and Labrador, indiscriminate development of the water resource has been permitted and wastage and misuse of the resource have occurred without proper appreciation of the real cost to the province and its future generations. Since the water resources of the province are substantial and of paramount importance to its future, comprehensive water resource planning and positive management should be undertaken now while the demand on the resource is still at a low level and corrective procedures are still possible.

In the absence of a policy leading to comprehensive planning for the water resources of the province, the federal and provincial agencies and the private companies with jurisdiction over water have tended to act unilaterally. The resulting lack of co-ordination has contributed to the inefficient use of the resource.

Policy and Management

The province urgently needs a comprehensive policy for the management of its water resources. This policy should recognize the multi-purpose nature of the resource and be designed to achieve maximum benefits for all users.

The provincial policy should be founded on the following major precepts:

1) Ensuring that all uses of the resource are developed in a rational and economic manner.

2) Ensuring co-operation between governments and avoiding program conflicts in spheres of federal jurisdiction.

3) Where its control has been invested in any party other than a provincial agency, reserving the right of the province to examine all development plans and make recommendations necessary to achieve the over-all development of the resource.

4) Providing safe water supplies to the province's population.

5) Providing wastewater treatment on a planned and progressive basis but as a secondary consideration to the provision of water supplies.

6) Ensuring that the management authority is empowered to control the use of the water resource and can finance water supply and wastewater treatment facilities.

7) Ensuring that all significant systems are licensed and their users are charged for withdrawal and degradation on a realistic but fair and equitable basis.

8) Ensuring that all works carried out under the direction or approval of the management authority meet acceptable standards.

9) Gathering data on the resource from federal and provincial sources to provide a sound base for long-term planning.

The Government of Canada can assist by developing an integrated policy for co-ordination among all federal departments concerned with water resources, in order to centralize assistance to and co-operation with the province in water resource development.

Legislation

The Water Resources and Pollution Control Act 1966-67 of the Province of Newfoundland and Labrador (the Act) gives legislative authority for the development of a comprehensive management plan. However, the enforcement of a management plan is limited by Section 17(2) of the Act which exempts several major areas of water usage from its jurisdiction. These exemptions concern hydro power rights assigned to the British Newfoundland Corporation Limited and the Newfoundland and Labrador Power Commission, and ore tailings discharges in Labrador. Such specific exemptions should be removed or modified in order to allow management planning to be effectively implemented.

Under Section 20(1)(q) of the Act provision for licensing withdrawals of water should be clarified to ensure that licensing covers degradation and the return of wastewater to the resource. Under Section 23 the powers to construct, take over, operate, and manage waterworks should be expanded to include wastewater collection and treatment facilities.

Management Instrument

The implementation of the water resources management policy of the province should be the responsibility of the Newfoundland and Labrador Water Authority (the Authority) as established under the Act. The Authority will need its own staff to develop and implement its programs as soon as possible, utilizing personnel from existing departments and employing outside services for its non-repetitive programs. Professional staff eventually needed will include - among others - economists, lawyers and accountants, as well as engineers.

Water Availability

The Province of Newfoundland and Labrador is one of the best endowed areas of Canada insofar as availability of fresh water of good quality is concerned. The average runoff (42 inches per year on the Island) represents one of the highest figures recorded in Canada. The water is generally distributed favourably in relation to development possibilities, so that if properly managed, sufficient water is available over the study period to 1981 to meet the foreseeable requirements for the expansion of industry, recreation, forestry, fisheries, and wildlife, as well as for human comfort and health.

Many small basins of the Island have relatively low dependable flows and will require the development of storage reservoirs and/or diversions to satisfy large water demands. However, the potential for storage development is good in most areas of the province.

The lack of underground storage on the Island limits the development of ground water in most areas to the supply of small demands. Practically anywhere in the province a supply of ground water of reasonable quality and in sufficient quantity to service individual houses and municipalities as large as 1,000 to 2,000 persons can be developed.

For most of the smaller communities the cost of water could be decreased if ground-water sources were developed on a more efficient basis than has been done to date. Current practice places too much emphasis on the bedrock as the water source and much more advantage should be taken of the ground-water capabilities of the surficial material. This requires greater skill in well drilling as well as hydrologic advice.

For the evaluation of water resource development programs and the granting of licences for various uses, it is essential that the province encourage the collection and analysis of additional data relating to water availability (quantity and quality) by federal agencies now carrying out data collection programs in the province, including:

1) The expansion of the existing climatologic and hydrometric networks in accordance with the planning guidelines suggested in this report, together with more detailed analysis to evaluate more specifically the future requirements for the networks.

2) The review of hydrologic records to correct for errors due to incorrect interpretation of changes in storage and in ice conditions, and a review of the hydrologic studies for the Island on the basis of these corrections.

3) The upgrading of the hydrologic studies for Labrador after additional data have been gathered from the expanded hydrometric network.

4) The eventual expansion of the hydrologic network to lakes and marshes.

5) The measurement of suspended sediments.

6) The establishment of a ground-water hydrometric network, and the reassessment of the conclusions reached in this study using the data from this network.

7) The substantial expansion of the water-quality network including the examination of estuaries and areas of waste disposal to the sea, and the reassessment of water quality on the basis of results obtained from this network.

Water Supply

Lack of adequate and safe water supplies for about one-half of the population is a potential hazard to the public health and is one factor contributing to lower and more restricted levels of living than those in other areas of Canada.

The provision of water supply and distribution systems for all communities of over 500 persons, including extensions within currently serviced municipalities, represents an estimated capital investment of some $95 million.

The unit cost of water supply and waste treatment increases rapidly when the community size falls below 2,000 persons. For a community of 500, the estimated cost per gallon for a community water supply is 2 to 2.5 times that for a community of 2,000 persons. Population relocation in larger municipalities could therefore result in significant reductions in waterworks and pollution control investment. Further economies could be achieved by combining municipal and industrial schemes to reduce unit costs, or by the development of regional water supply schemes. However, even with these economies, it is apparent that the cost of providing a complete community waterworks system, if borne entirely by the consumer, could result in a charge to him that would exceed the limit of his ability to pay for that service, and some form of subsidy may be required.

In many areas such as Topsail-Seal Cove in the St. John's Study Area (Map 16), there are potential hazards to the public health from the contamination of existing individual or private wells, and action in providing improved water supplies is urgently required. For those communities whose size remains at 500 or less, it is obvious that a community water supply system will be difficult to justify financially. However, satis-

factory individual well supply systems can be developed and their contamination avoided if the installation of these systems is placed under rigid control and inspection.

Based on present economic forecasts and assumptions, the capital investment for water supplies required for planned major industrial development on the Island at Come by Chance and Stephenville and extensions to the Price and Bowaters pulp and paper mills is estimated at $10.2 million. This represents a very low unit cost of water, of as little as three cents per 1,000 gallons, with the system fully utilized.

If it is to deal effectively with problems of water supply, the Newfoundland and Labrador Water Authority should give early consideration to the following steps:

1) To establish a program of providing central water supply and distribution systems for those municipalities or communities whose populations exceed 500 including those municipal areas where the existing system serves only a portion of the population.

2) To take over and operate all water supply systems in both incorporated and unincorporated communities, as a means of improving operating efficiency and standard of service.

3) Where, for public health or other reasons, it is necessary to provide water supplies to communities of less than 500 persons, to build and operate the facilities on behalf of the responsible department.

4) When requested and when such action is considered beneficial because of economies of combined use, to take over or build and operate water supply systems for industries.

5) To base priorities for installation of water supply systems on benefit-cost criteria, taking due account of intangible factors such as public health.

6) To give careful consideration in all water supply systems to the possible development of ground water as a cheaper alternative to surface water sources.

7) As a means of reducing the investment in water supply and distribution systems, to develop programs which take into account plans for concentrating populations in larger centres, and to direct planning toward developing ground-water supplies, grouping industries and municipalities in combined and regional supply schemes, reusing water in industrial processes, etc. The use of sea water for cooling, fluming, and fire protection should be given greater consideration in future developments in the province.

8) To prohibit any activity which would endanger the quality of the fresh water resource at the intake areas of potable water supply unless adequate measures are taken to protect the supply. The multiple use of water supply reservoirs should be permitted only if justified by benefit-cost analyses.

9) To require standby equipment at all chlorination installations in the province. This will avoid a deterioration of the water supply in the period between the breakdown of equipment and its repair.

10) To make a precise determination of municipal water demands according to use and for various types and sizes of communities in the province.

Water Quality

Quality Degradation

Water quality degradation by industrial and domestic wastes is widely tolerated and is causing serious conflicts with fisheries, recreation, and tourism in the St. John's area, the Exploits River, the Churchill River, and the Humber Arm. Furthermore, the quality of the supply to existing or potential downstream users is directly affected and, in some instances, is posing a threat to the health of the general public.

The permissive attitude to water quality degradation by both government and citizens alike has resulted in an eventual cost of correction for which there is currently no planned financing. This attitude has permitted resource users, particularly industry, to ignore the need to protect the resource by water reuse and conservation and the control of wastewaters. Unless action on pollution abatement is taken soon, efficient use of the water resource in many areas will become severely restricted and the cost of effecting adequate pollution control will become excessive.

Primary treatment (flocculation and sedimentation) should generally be sufficient to reduce the strength of the industrial and municipal waste discharges to inland waters to a satisfactory level through the study period to 1981. With the exception of certain communities such as St. John's and Botwood, it should be possible to control pollution along the seacoast during this period through efficient diffusion and dispersion of effluent from properly located marine outfalls. Ground-water pollution could be controlled through improved practices in the installation of wells and septic tanks and the siting of solid-waste disposal areas.

The total investment to provide municipal wastewater treatment plants for eight communities[1] where pollution problems appear severe would be $15 million. To this must be added the cost of installing or modifying collection sewers.

An expenditure of more than $18.5 million would be required to effect even a minimum level of pollution control for major areas of industrial and mining waste discharge in the province.[2]

Water Quality Control

To provide direction to its pollution control program, the Authority should establish a system of water quality standards in relation to the uses of the province's fresh and inshore waters. Under its over-all resource management policy, it should be possible to determine the priority of spending needed to maintain these standards.

Where wastes are discharged which degrade the waters below the required standards, charges could justifiably be levied against users to assist in defraying eventual cost of treatment.

Industries producing toxic or other objectionable wastes should be encouraged to carry out research into their processing methods in order to minimize pollution of the waters receiving their wastes.

Adequate quality control could best be achieved if the Authority were to assume direct responsibility for the construction and operation of all pollution control facilities, including those now privately owned.

Discharge of municipal and industrial wastewaters to the sea without significant treatment may be permitted provided the point of discharge is carefully selected. The selection should be based on oceanographic studies to ensure that adequate dispersion and diffusion are attained and that other local uses are protected. All systems should be designed so that future treatment can be reasonably incorporated.

Highly complicated and automated systems of pollution control should be avoided wherever possible due to the difficulty of readily obtaining parts and service personnel in the widely scattered communities of the province. Primary treatment or oxidation ponds should be given every consideration as acceptable treatment methods for the short term.

1/ St. John's, Corner Brook, Grand Falls-Windsor, Bishops Falls, Botwood, Buchans, Norris Arm, Dunville.

2/ Exploits, Humber, Churchill River basins, Burin Peninsula.

The full effects of insecticide spraying on the environment, including the water resource, have not been established. Spraying in connection with forestry or other activities should be carried out only after careful investigation.

Non-withdrawal Use

Hydroelectric Power and Storage

Development for hydroelectric power generation has been accepted as a paramount use of the water resource virtually without regard to other actual or potential users. As a result, the real costs and benefits to the province for the development of hydroelectric power schemes have not been properly evaluated and conflicts have occurred with other water users. For example, diversions for hydroelectric power have conflicted with fisheries development plans on the Exploits River, and resource conflicts are inherent in the proposed Terra Nova hydro development. Conversely, while conflicts exist with other water uses, significant benefits have resulted from improved flow regulation in some areas.

Stage II of the Bay d'Espoir development will be completed by 1971 bringing its installed capacity to 450 Mw. During the study period to 1981 further development of hydroelectric power on the Island will be limited to additional units at Bay d'Espoir and possibly other schemes developed for peaking power. Base load energy will be supplied from either hydroelectric generation in Labrador or from new Island-based thermal generation including the 300 Mw Holyrood plant due for completion in 1971. These developments will change the operation of existing small plants on the Island. Many of the older, smaller hydroelectric plants will probably be closed down during the next few years and storage reservoirs at these plants could then be utilized for water supply or recreation.

The Cat Arm River hydroelectric scheme is the most attractive scheme for development of those identified during this study and has a minimum of water resources conflicts. The estimated capital cost of installing 120 Mw at this site is $37.5 million.

A few pumped storage sites are available on the Island, particularly in the Great Northern Peninsula, but their development is not considered likely during the study period.

In Labrador, hydroelectric power development will continue for export from the province, for service to the developing local economy, and for transmission to the Island. Apart from the Churchill River, several other Labrador rivers have excellent hydroelectric potential, including the Eagle, the Canairiktok, and the Naskaupi. However, the proposed diversion to the Upper Churchill watershed would significantly reduce the potential of the Naskaupi River.

The Authority should undertake an investigation in association with the Newfoundland and Labrador Power Commission and the private power companies to resolve existing conflicts in use related to hydro development.

1) All hydroelectric schemes proposed by the Newfoundland and Labrador Power Commission, or by the private companies with rights to develop power in the province, should be thoroughly examined to identify possible conflicts with other uses such as fisheries, forestry, recreation, and tourism. The assignment of costs and benefits for any modifications to the schemes which would change the basic cost of power should be negotiated between the Authority and the utility concerned.

2) A program should be established in co-operation with the British Newfoundland Corporation Limited (Brinco) to determine the undeveloped hydroelectric potential of Labrador, especially in the southern region. This program would determine the availability of local power sources for future industrial developments and identify potential conflicts with other water users as a basis for comprehensive resource planning.

3) To complete the inventory of hydro power potential for the Island, the Newfoundland and Labrador Power Commission should carry out more detailed investigations to assess the economic viability of the following schemes:

   Cat Arm
   Upper Humber River
   Main River
   Star Lake
   Hinds Brook
   Western Brook Pond (pumped storage)

   These investigations should take into account the system requirements, transmission costs, and the requirements of other water users.

4) Consideration should be given to alternative uses of storage at the existing small hydroelectric schemes on the Island (less than 5,000 hp) in the light of present power costs and developments.

5) Flooding of commercial forest areas by hydroelectric or other storage reservoirs should be subject to prior approval by the Authority, and the possibilities of clear cutting should always be investigated.

Log Driving

Log driving, although apparently on the decline, has created problems for fisheries and other users due to flow variations and bark deposits, particularly in the basins of the Humber and Exploits Rivers. Conversely, log-driving capabilities on smaller rivers have been restricted by the river barriers and flow control associated with hydro power developments. In the future log driving will tend to concentrate on the three larger rivers, the Exploits, Humber, and possibly the Churchill, which are, or soon will be, regulated for hydro power.

Whenever comparisons are being made by pulp and paper companies between alternatives of log transportation, the deleterious effects of log driving on water quality and the river flow regime should be carefully considered. The transportation by pipeline of pulpwood in the form of chips should be investigated. This method of transportation would exert less demand on the water resource, and should be considered in future construction or modernization programs.

Recreation and Tourism

Increased use of natural resources in the province for recreation and tourism will continue and will have some direct effect on the pattern of the present non-withdrawal uses for hydroelectric power, log driving, and waste disposal. The careful and well-planned development of fisheries for fresh-water-dependent species and the protection of wildlife are essential to achieve maximum benefit from the development of recreation and tourism for both the residents of the province and for visitors.

The development of fisheries, wildlife, tourism, and recreation are closely related and are dependent on the quality and quantity of the water resources. The Authority should recognize the needs of these non-withdrawal activities and incorporate them in its over-all planning.

Regulation and Control

For the protection of the resource, the Authority should immediately undertake the licensing of all significant users of shore, surface, or ground waters in the province in respect of withdrawal, non-withdrawal, and return rights. Users who withdraw less than 2,000 gallons per day according to the Authority's best estimate could well be excluded from licensing requirements.

Regulations (under Section 20 of the Act 1966-67) are needed to govern to following:

1) The application and granting of water-use licences and all related charges.

2) The design, construction, and operation of private and public water and wastewater facilities, including the provision for the Authority's approval and inspection.

3) The location, design, and construction of ground-water withdrawal systems, including the related licensing of all well drillers and the inspection and approval of their work by the Authority.

4) The design and construction of wastewater outfalls into shore waters, including estuaries, harbours, and embayments with provision for their approval and inspection by the Authority.

5) The standards of quality of all water supplies intended for human consumption and the provision for regular quality inspection by the Authority or the Provincial Department of Health.

Financing

Expenditures in excess of $105 million have been forecast as necessary to adequately supply water to that portion of the unserviced population residing in communities of 500 or more, and to potential new industries. An additional expenditure in excess of $33 million would be required to control the more significant effects of wastewater discharges occurring to the water resources of the province at this time. It is therefore incumbent upon the province to determine as soon as feasible the rate of annual spending that can be directed to water supply, wastewater control, and resource management by the Authority, so that a long-term implementation program can be developed.

The Authority should include, within its policy of licensing, a basis of charging for the effect of use on the quantity and quality of the resource. These degradation charges should be established by determining the effect of each use on the resource through diversion and energy loss, as well as physical, chemical, and biological degradation.

Charges should be established and licensing commenced now to provide funds which will assist the Authority in financing its extensive program. Charges to existing users should be initiated at a portion of the normal charge, increasing annually until the full rate is reached. These charges would be made directly against a municipality, industry, or other major user operating its own system.

Where a water supply system is taken over or provided by the Authority, the customers should be required to pay for at

least some portion of the cost of the direct service, as well as some portion of the cost of degradation. By the inclusion of the degradation assessment, the Authority should agree to protect the user from any further responsibility for the effects of wastewater discharges.

Where the municipality or the industry maintains now, or constructs later, its own water supply system, a bulk charge should be levied for the cost of degradation representative of the cost of wastewater treatment which would eventually be installed by the Authority. The payment of these charges should protect the user from further responsibility in relation to water degradation.

The scattered population distribution and relatively low income levels within the province may well require that charges established on a provincial basis be modified through subsidy for implementation in certain localities.

Planning

The existing climatologic, hydrometric, and water-quality networks in the province, particularly in Labrador, are inadequate to define the characteristics of the resource at a level required for detailed water resource planning. Systematic collection of data on ground water and suspended sediments does not exist and is also required.

The examination of selected river basins and study areas for development possibilities and conflicts in water use has identified four regions which immediately require comprehensive planning. The study of the areas is essential to develop solutions to existing conflicts and plans for water resources management in the regions. The regions, in order of priority, are:

1) Exploits River Basin
2) St. John's Study Area
3) Churchill River Basin
4) Humber River Basin

The Authority should request the Lieutenant-Governor in Council to appoint in each of these four regions Local Advisory Boards under subsection 5(4) of the Act 1966-67. All jurisdictional levels and types of water users should be represented on these Boards, which would be responsible for giving the Authority assistance in developing comprehensive water resource plans for the regions concerned.

Exploits River Basin (Map 8)

In the Exploits River basin comprehensive planning should include the following major considerations:

1) A critical review of the water quantity and quality requirements of present and potential users and the optimum methods of obtaining them.

2) Investigation of the location, costs and benefits of providing additional storage in the upper portion of the basin to offset the serious water resources conflicts which have been accentuated through recent diversion from the watershed.

3) Optimum methods for waste treatment in respect of pulp and paper effluents and mine tailings.

4) An economic appraisal of the possibilities of further hydroelectric development, including the replacement of outdated facilities, and their effect on other uses.

5) A general appraisal of the economics of fisheries, tourism, recreation, and wildlife development in the basin through federal and provincial agencies concerned. This appraisal should recommend action to avoid the loss of anadromous fish (e.g., salmon) in the Exploits River due to rise in pollution levels following the diversion of flow from the Victoria and Lloyds Rivers to the White Bear River Basin.

St. John's and Environs Study Area (Map 16)

In the St. John's Study Area comprehensive planning should consider the following:

1) The eventual provision of adequate municipal water supplies and sewerage systems for all communities in the study area with populations over 500. The construction of these systems could be deferred if the standards of construction and operation of existing privately-owned wells and septic tanks were improved. Regulations to cover this should be instituted as soon as possible, along with a technical advisory service.

2) Present discharges of untreated wastes to the fresh water resource should be studied carefully and controls instituted to protect public health.

3) Pollution of the Waterford River and the Quidi Vidi Lake complex should be reduced to restore the recreational use of these waters.

4) The use of water from Bay Bulls Big Pond as a source of supply for the City of St. John's should be considered as an alternative to the development of a high dam diversion on the Broad Cove River.

5) In conjunction with the installation of residential water meters in St. John's, an investigation should be undertaken to determine the water rate structure that will encourage a reduction in average per-capita water demand.

6) A regional water supply system should be established to serve the residential development extending from Topsail to Seal Cove. This recommendation should be given immediate attention in view of the potential health hazards reported in the area.

7) Relatively large quantities of water are stored at the six hydroelectric generating stations in the study area. The use of these waters for industrial purposes should be considered at such times as the generating stations cease to operate, or earlier if satisfactory arrangements can be concluded with the Newfoundland Light and Power Company Limited.

Churchill River Basin (Map 15)

In the Churchill River basin, comprehensive planning should include the following major considerations:

1) A detailed inventory of all natural resources in the basin should be completed. Particular attention should be given to hydroelectric energy, minerals, forestry, fisheries, and wildlife. A complete picture of the development possibilities and problems is essential to planning the harmonious development of these resources.

2) The re-examination of the tailings disposal system by the iron ore industry with a view to reducing pollution of the Churchill River headwaters. The future use of the area for fisheries and recreation and tourism may be seriously affected by this pollution because the toxic characteristics of these wastes may destroy the environment of the resource. Action should be taken before it becomes impossible to protect this environment.

Humber River Basin (Map 9)

In the Humber River basin comprehensive planning should include the following major considerations:

1) A preliminary water quality survey of the Humber Arm to assess the extent of pollution from the pulp and paper mill wastewaters, and - if necessary - means of alleviating it.

2) The assessment of long-term plans for forest exploitation and related activities in the area.

3) An analysis of the development possibilities for recreation and tourism and related fisheries and wildlife development.

4) Provision of adequate water supplies for the rural population.

Other Basins and Study Areas

Proposed courses of action concerning water resource problems disclosed in other river basins and study areas, ranked generally in order of priority, are as follows:

1) South Coast River Basins and Bay d'Espoir Study Area (Map 10)

a) A program for assessing the actual hydrologic conditions in the area affected by the hydroelectric development should be prepared and implemented. River and precipitation gauges should be installed at all diversion points and near the mouths of the White Bear and Grey rivers. These installations will enable calculations of the actual loss of energy at the hydro plants on the Exploits River and the actual compensation flows required for Atlantic salmon in the White Bear and Grey rivers, as well as extending basic hydrologic knowledge of the region required for the implementation of a water resources management plan.

b) A water resources management plan should be prepared to reduce the conflicts of interest between fisheries, wildlife, and hydroelectric power, and to take maximum advantage of the tourism and fisheries potential in the region.

c) The potential water supply for industries and the supporting services available in the Bay d'Espoir area should be considered in the selection of locations for new industries requiring significant amounts of water.

d) Investigations should be carried out to ensure that proper disposal of wastewater in respect to oceanographic conditions can be achieved so as to avoid unnecessary shore pollution.

2) <u>Terra Nova River Basin</u> (Map 11)

a) Industrial development should be discouraged in this basin, and emphasis should be put on forestry, recreation and tourism, wildlife and fisheries development.

b) The full implications of the proposed hydroelectric scheme, which involves several diversions and reservoirs and will consequently affect the fisheries, forestry, and wildlife resources of several adjacent basins, should be determined. A water resources management review should be carried out, in advance of a decision to proceed with the hydro development, making a careful evaluation of all factors. This will avoid the necessity for <u>ad hoc</u> solutions similar to those required in the Exploits basin. Full attention needs to be given to the potential conflicts of interest between log driving and fisheries, should forest exploitation recur in the basin.

c) Consideration should be given in the water resources management study to the possibility of enlarging the present boundary of Terra Nova National Park to include Terra Nova Lake and the area along the main river stem from the lake to the river mouth. This part of the basin could then be included in the recreation and tourism development plans of the National Park. This would bring an Atlantic salmon river into the park boundary, provide a large freshwater lake with sandy beaches in the park area, and enhance development opportunities in the west end of the park. In addition, houses in Terra Nova village could be acquired to provide additional accommodation for park visitors.

3) <u>Gander River Basin and</u>
<u>Gander-Glenwood Study Area</u> (Map 12)

a) Development of the basin for use by anadromous and fresh-water fish should be continued since conflicts of interest with other users are minimal and will continue to be so in the future.

b) In addition to the development of the basin for fisheries, efforts should be directed toward developing the area for recreation and tourism, taking advantage of the existing transportation network and water resources.

c) The quality of water for domestic purposes should be monitored throughout the basin to classify all sources of potable water, to identify potential problem areas, and to provide background data for corrective action.

4) Cat Arm River Basin (Map 13)

a) The hydroelectric potential in this basin should be considered for future development and more detailed studies carried out to assess this potential. These studies should be carried out in conjunction with a complete assessment of other natural resources to permit integrated resources development in the area.

b) A recording rain gauge should be installed in a representative location in this basin to complement the automatic river gauge recommended earlier in this study and installed by the Canada Department of Energy, Mines and Resources in 1968.

5) Pipers Hole River Basin (Map 14)

a) The provincial government in co-operation with interested federal agencies should establish guidelines for forest management and fish and wildlife conservation in the basin.

b) The effects on the area downstream of the diversion of the upper area of the Pipers Hole River proposed for the Terra Nova hydro power development should be ascertained.

6) Come By Chance and Environs Study Area (Map 17)

a) The study area is served by excellent road and rail facilities and has potential harbour sites on Placentia Bay. Further industrial development in the area should be actively encouraged to complement that already undertaken. Such development, however, cannot be unlimited in view of the relative lack of large quantities of water.

b) In view of the importance of the Come By Chance River as a source of water to the industrial complex, a recording flow gauge on the river should be installed.

c) In the region of Placentia and Dunville, surface waters suitable for recreational use should be developed. In addition, surface waters and their drainage areas required for potable water supplies should be delineated and protected to maintain water quality.

d) Large volumes of industrial and municipal wastewaters are to be discharged to the Bay in this area. Careful oceanographic studies should therefore be carried out to evaluate the adequacy of diffusion and disposal in the sea, or the requirements for treatment of such wastes.

7) Burin Peninsula Study Area (Map 18)

a) This area has limited natural resources and lacks major water supply sources. Because of this, the area should not be assigned a high priority with respect to the establishment of a water resources management plan.

b) Steps should be taken to preserve Freshwater Pond for recreational use.

8) Stephenville and Environs Study Area (Map 19)

a) To ensure a satisfactory quality of raw water, further settlement without adequate domestic wastewater treatment in the catchment areas of the water supply serving the town of Stephenville and the former Ernest Harmon USAF base should be prohibited. If this cannot be accomplished, it will be necessary to treat all potable water derived from these drainage areas by filtration as well as chlorination in order to ensure water of acceptable bacteriological quality.

b) Wastewater from industrial development in the Stephenville area, with the exception of cooling waters and wastewaters containing no organic pollutants or settleable solids, should be discharged to the sea (St. George's Bay) rather than to Stephenville Pond. Wastewaters conveyed to the sea for ultimate disposal should be discharged in such a manner that adequate dispersion and dilution can be achieved.

9) Bonavista Study Area (Map 20)

a) Settlement in the Bonavista study area outside the municipalities of Bonavista, Catalina, and Port Union should be discouraged.

b) Individual dug wells and septic tank systems in the study area should be brought up to acceptable standards. Construction of new wells and septic tank systems should be regulated to ensure compliance with acceptable standards.

WATER RESOURCES
of the
ATLANTIC PROVINCES

PART THREE

THE LEGAL FRAMEWORK

PART THREE - THE LEGAL FRAMEWORK

1. INTRODUCTION

The basic legal framework of water resources in the Atlantic Provinces was developed by the English courts over the centuries in settling disputes between individual litigants. This is the common law background. The common law of England, along with the few operative British statutes in the field at the time of settlement, were adopted as the rule of decision in the colonies that later became the Atlantic Provinces, with such modifications as were felt by the judges to be suitable to the situation and conditions of these colonies. The common law is not a static system and was molded both in England and in the colonies to meet changing societal needs. Moreover, colonial statutes at times made minor changes to the common law.

The common law has made some marked distinctions between the rules applicable to water, depending on the way in which it is found in nature. One clear distinction is between watercourses, such as rivers, streams and lakes, which flow in a fairly regular manner in channels between banks that are more or less defined, and surface and ground waters, those accumulations and flows of water not sufficiently large, defined or permanent to constitute a watercourse. The waters of the sea that wash the coast have their own special rules and will be discussed in that connection. In this study, then, waters have been classified as watercourses, surface waters, ground waters, and coastal waters. In addition, interprovincial and international rivers will be discussed in separate sections. Parts of the law respecting coastal waters also apply to tidal streams and lakes and, for convenience, will be dealt with under watercourses. It may be noted, too, that the law applicable to artificial watercourses is that of surface waters, except where the watercourse is permanent, when the law respecting natural watercourses is applied. Finally, underground watercourses are generally subject to the same laws as watercourses on the surface but there are serious difficulties in establishing that subterranean waters are in fact watercourses.

When Nova Scotia and New Brunswick joined Upper and Lower Canada to form the Dominion of Canada in 1867, the pre-existing water laws in these provinces, in common with other laws, were continued, subject to their being modified, repealed or replaced by other laws by the appropriate legislature. The same provision was adopted when Prince Edward Island and, later, Newfoundland joined the union. The appropriate legislature is determined by reference to the appropriate heads that divide legislative power in Canada between the federal and provincial legislatures. This constitutional division of authority, so far as it applies to the law of waters, will be examined before turning to the framework of the law of waters in the Atlantic Provinces.

2. THE CONSTITUTIONAL POSITION

General

The principal bases for federal legislative power over waters may be found in the preamble to section 91 (the "Peace, Order and Good Government" clause), and the following specific heads: Sections 91(1A) (public property), 91(7) (fisheries), 91(24) (Indian lands), 91(27) (criminal law), 91(29) and 92(10) combined (works and undertakings extending beyond a province, and works declared to be of general interest by the federal parliament), 92 (agriculture), and 132 (the Empire treaty clause). In legislating within its sphere, the federal parliament has paramount power; whenever federal and provincial legislation overlap, federal legislation prevails.

The principal bases for provincial legislative power over water may be found in Sections 92(5) (public lands), 92(8) (municipal institutions), 92(10) (local works and undertakings), 92(11) (incorporation of companies), 92(13) (property and civil rights), 92(16) (local or private matters), and 95 (agriculture). Some of these constitutional heads of power affect many aspects of water development, and require some brief exposition before proceeding to the functional implications of the division of legislative power.

Particular Powers

"Peace, Order and Good Government"

The "Peace, Order and Good Government" clause, along with the closing words of Section 91 of the B.N.A. Act, appear to have been intended as a residuary source of legislative power. In fact this residuary role has been confined by judicial interpretation to matters that by their nature affect Canada generally or go beyond the concern of any one province. In the field of water law, the reference Re: Offshore Mineral Rights of British Columbia held that the federal parliament had by virtue of this clause jurisdiction over the offshore resources off British Columbia. Again relying on this clause, the courts have developed an "emergency power"; consequently if a health crisis developed from water pollution or other cause the federal parliament would have legislative powers respecting the matter. For most purposes, however, the provincial powers over property and civil rights and local and private matters have served as residuary clauses.

Public Property

Section 91(1A), which gives the federal parliament exclusive power over its public property, is a most important source of federal power in relation to the development of water resources. In the first place, the federal government may do whatever it wishes with its property. Accordingly, where it owns land it may develop any water or water powers connected with it, and make any legislation concerning that property even if such legislation would ordinarily fall within provincial ambit. So long as it retains title, the federal government may lease the land and control its development, including the development of any water in or on the land. What is more, provincial legislation does not apply to federal property, so that the development of water on federal lands is free of provincial regulatory control. This federal exemption from provincial legislation, if widely interpreted, could raise most serious problems where provincially authorized works on provincially or privately owned lands affect the flow of water on federal lands.

Though the federal government cannot compulsorily acquire land, except for purposes falling within its ordinary legislative powers, there is nothing to prevent it from using its money to buy land and other rights for the management of water; for public money, too, is public property which the federal government may use as it wishes.

In addition to the property the federal government may have acquired by purchase, expropriation or otherwise, under the B.N.A. Act the provinces transferred to the federal government a number of assets relating to its legislative powers. The B.N.A. Act was later made applicable, with modifications, to Prince Edward Island, and express provision was made for the transfer of similar assets by Newfoundland. Some of the assets thus transferred have direct reference to water resources. These assets include canals, including connecting lands and water power, public harbours, aids to navigation, and river and lake improvements.

The Federal Spending Power

The fact that money is public property considerably strengthens the federal government's power in the field of water development. Thus it may promote the development of water resources by means of grants to individuals, private organizations, municipalities or the provinces. And it may influence the direction of such development by attaching conditions to the grants. But, while it can influence, it cannot regulate water development by means of this "spending" power. Among other limitations this implies, it means that the provinces, within the areas of their legislative competence, could regulate water resources in such a way as to frustrate federal initiative in

water development. The federal government may also promote the development of water resources by lending; this power may be somewhat broader than the spending power, for a debt owing to the federal government is property and federal legislative power may be exercised over it.

Defence

The federal parliament's power over defence under Section 91(7) of the B.N.A. Act probably authorizes it to do anything for that purpose, including the development of water and water works ordinarily falling within provincial competence. This would include the compulsory taking of land, which is in any event provided for by Section 117 of the Act. Parliament could not under the guise of legislating respecting defence, however, take jurisdiction over water development generally and would probably not attempt it. It is well to remember, however, that once the federal government has legitimately appropriated land for a purpose, it becomes public property and it may use it as it sees fit.

Criminal Law

Under Section 91(25) of the B.N.A. Act, the criminal law power, the federal parliament may prohibit the pollution of water and enact other prohibitions for the protection of public health. But criminal law being essentially prohibitory, the federal government could not set up administrative controls or other regulatory powers relating to pollution.

Extraprovincial Works and Undertakings

By the combined operation of Sections 91(29) of the B.N.A. Act, works and undertakings connecting the province with other provinces or extending beyond the limits of a province come within federal legislative power. Among matters relating to water, canals and lines of ships are expressly named. It would also appear to include water distribution systems situate partly in one province and partly in another province or a foreign country. It would also include undertakings for hydro-power development and distribution connecting two or more provinces or extending beyond the limits of a province; this would apply to hydro-electric power developments wholly within a province if the connecting power distribution system is in substance an extraprovincial undertaking.

The Declaratory Power

In addition to jurisdiction over extraprovincial works and undertakings, Sections 91(29) and 92(10) of the B.N.A. Act, read in conjunction, give the federal parliament power to extend its legislative power over any work, though wholly situate within a province, by declaring it to be for the general advantage of Canada or of two or more provinces. This could be exercised in respect of works related to the development of water resources. The exercise of the declaratory power raises political issues of great importance, however, and in recent years it has been rarely exercised.

Agriculture

Section 95 of the B.N.A. Act gives the federal parliamant and the provinces concurrent power over agriculture, and expressly provides that in case of conflict federal law prevails. Though agriculture has been strictly limited to matters of direct relation to, or concern with, agricultural operations, it would certainly appear to comprise marshland reclamation and irrigation.

Empire Treaties

Section 132 of the B.N.A. Act gives the federal government all power relating to the obligations of Canada under a treaty of the British Empire. The power is most important because it underlies federal power over a number of important water treaties, notably the Boundary Waters Treaty, which provides a framework of laws governing the international and boundary waters of Canada and the United States. Apart from its power under such treaties federal jurisdiction over international and boundary waters remains unexplored. Section 132, however, applies only to Empire treaties, not to treaties negotiated by Canada. The federal government has power to negotiate treaties for Canada, and on ratification such treaties apply to Canada under International Law, but incorporation of their provisions as part of the law of the land must be done in accordance with the ordinary division of power between the federal and provincial governments. There is no legislative power respecting treaties, as such, apart from Empire treaties. The provinces may enter agreements with other states and implement them in the exercise of their ordinary legislative powers.

Provincial Powers

As already mentioned, provincial power to legislate respecting property and civil rights, and local or private matters in effect constitute a residuary legislative power and under these a province may, in relation to water development, exercise inter alia, jurisdiction over water supply, power development, water conservation, flood control, pollution and recreation. Subsidiary sources of provincial power include their control over municipalities (to which they may delegate any provincial powers such as the provision of water supply), over local works and undertakings, for example, dams, bridges, intraprovincial lines of ships, and over agriculture which, subject to federal legislation, gives them control over irrigation and marshland reclamation. The provinces' authority enables them to expropriate land within their territories for any purpose, even without compensation, though the courts would lean against interpreting legislation as permitting compulsory taking without compensation.

Another important provincial power is Section 92(5) giving the provinces power over the management and sale of public lands. As in the case of federal jurisdiction over its property, this enables a province to do anything in respect of its lands that a private person may do, and to enact legislation in regard thereto. This permits it entry into what otherwise might fall exclusively within the federal domain. In relation to water, for example, a province may deal with fisheries or improve navigation on its lands. This is, of course, of the highest importance because the public domain is vested in the provinces. It is, however, subject to overriding federal legislation.

In common with the federal government, the provinces also exercise "spending" and "lending" powers. This permits the provinces to exercise influence, for example, by conditional grants, over areas of federal concern, such as the development of fisheries and the improvement of navigation.

Functional Description of Constitutional Problems

The foregoing constitutes a brief introduction to several of the major sources of federal and provincial constitutional power. The implications of this constitutional division of power may perhaps best be seen by looking at the matter in functional terms.

Navigation

The control of navigation falls within the federal power under Section 91(10) of the B.N.A. Act to regulate navigation

and shipping. The head comprises power to regulate navigation, to improve the navigability of water and to prevent the erection of works that might impede navigation, either absolutely or on condition of obtaining a licence or permit. Though there may be room for some doubt, it would appear that the federal government may expropriate for navigation purposes, but the power could not be used as a cloak for permitting expropriation of even closely related works. Any attempted use of the navigation and shipping power to effect other purposes, such as hydro-power development or flood control, would probably be kept within a very narrow ambit. It seems clear, for example, that works in navigable waters for power development alone could not be justified under this head. In fact, though the federal parliament has ample discretion to decide what works may be necessary to improve navigation, there is no reason to believe that these works might be used for purposes such as power development, however convenient this might be. It may be, of course, that works for the improvement of navigation, for example, by means of storage, might incidentally serve to control flooding as well as to improve navigation, but it is doubtful if the navigation and shipping power could be much more extensively used as a lever for federal exercise of jurisdiction over flood control. In such areas federal-provincial cooperation seems called for.

The regulation of navigation being in the federal parliament, the provinces are incompetent to authorize interferences with navigation, even in the absence of federal legislation. They can, however, authorize the construction of works that would interfere with navigation and incorporate companies for the purpose, but in the absence of federal permission such works would be subject to removal by the federal or provincial Attorney-General or anyone seeking to exercise his right of navigation. It follows that works falling within provincial competence - for example, hydro-electric power development - if constructed in navigable waters may require authorization from both provincial and federal authorities.

Finally, it might be mentioned that while legislative power over shipping and ferries is vested in the federal parliament, the provinces may incorporate and regulate intraprovincial lines of ships and ferries, subject to their complying with federal navigation laws.

Fisheries

Section 91(12), "Sea Coast and Inland Fisheries", gives the federal parliament general power to regulate fishing, including the establishment of licensing schemes and closed seasons and making provision for the preservation of fisheries; it would include power to prohibit pollution for the purpose. It should be observed that the power is limited to fisheries; It does not include the regulation of fish as an article of trade. However, a provision preventing the possession of fish

as ancillary to the regulation of the fisheries, for example, in assisting to maintain closed seasons or a prohibition to catch certain fish would certainly be valid.

Section 91(12) is intended to give legislative power, not property rights. Accordingly, while the federal parliament may, in regulating fisheries, serously affect property rights - for example, by prohibiting a landowner from fishing on his land - it cannot legislate respecting his property rights as such - for example, by giving a federal licensee exclusive power to fish on another person's land unless, at least, this can be justified as in some way benefitting the fisheries. This may lead to the belief that expropriation cannot be justified under the fisheries power, but the probability is that federal expropriation for this purpose may be justified if shown to be necessary for the effectual exercise of the power.

On tidal waters there is a public right of fishing that overrides any private right of fishing, so that federal power may be exercised without regard to rights of property in fishing. This is limited to ordinary fishing. Fishing with weirs and other instruments requiring the use of the solum requires the permission of the landowner, whether this be a private individual or a province.

The provinces do not have authority to legislate respecting fisheries in a general sense. But the provinces have considerable power over their own fisheries. Provincially-owned land, like privately-owned land, carries with it the right to fish in any waters thereon. Subject to complying with federal laws respecting fishing, therefore, a province may exercise this right and permit individuals either by lease or permit to use the right subject to such terms and conditions as it sees fit to impose. It may also do this by legislation as an aspect of legislation respecting the management of provincial lands. The federal and provincial legislation may exist concurrently, but where there is conflict federal legislation will prevail. As already mentioned, provincial property rights may extend into tidal waters, and where use of the subsoil is required for certain types of fishing, for example, oyster fishing, the provinces may make provision by legislation to lease areas for conducting such fisheries. In some cases, however, the provinces have transferred to the federal government the administration of provincially-owned oyster beds.

Floating

It is not clear which legislature has the power to regulate the right to float logs, as distinguished from the right of navigation, though such authority as there is indicates the provinces can do so; they may certainly incorporate companies for the purpose. But where floating is conducted on navigable, not merely floatable rivers, the federal parliament can regulate

it as an aspect of navigation. Possibly provincial laws respecting floating would apply on such rivers, subject to being overridden by conflicting federal legislation.

Flood Control

Flood control projects fall generally within the provincial sphere. Federal works for the improvement of navigation may, of course, incidentally result in the control of flooding, but it is extremely doubtful if the navigation power may be exercised to foster flood control measures except as a necessary adjunct to improved navigation. On its own lands, however, it would appear that the federal government could erect flood control projects, though it could be argued that this was not really legislation respecting public property unless the lands themselves benefitted. The declaratory power could, of course, be exercised to bring in flood control projects withing the federal sphere.

Pollution

A province may control the pollution of water, whether this be in connection with municipal water supply, running streams or surface and ground waters as well as tidal waters within the limits of the province.

The federal parliament may prohibit pollution under its criminal law power, at least where it would constitute a danger to public health. Criminal law, however, gives no regulatory powers. The federal parliament also has jurisdiction to prevent pollution for the preservation of fisheries and in the interests of navigation and shipping. The latter power would at least encompass the regulation of ships disposing of deleterious matter in waters. In any event, the federal parliament would have power to regulate pollution, within the limits permitted by international law, in areas of the sea falling outside the limits of the provinces. It probably has some jurisdiction over pollution in international streams to meet its obligations to other countries, and it may have power over pollution of interprovincial rivers where pollution in one province deleteriously affects persons in other provinces. Again, there seems no doubt of the federal parliament's power to regulate pollution in national crises. Finally, some Empire treaties may impose responsibilities on the federal parliament to prevent pollution.

Water Supply

Power to make laws respecting the supply and distribution of water, whether for domestic or industrial purposes,

generally lies with the provinces. This includes control of pollution, chemical treatment, fluoridation and the like. The provinces must not, however, interfere with the public right of navigation, federal public property and Indian lands, and valid federal legislation within its own fields, for example, prohibitions against pollution, but the area of provincial control is obviously wide. Federal legislative power would appear, however, to extend to water supply systems crossing interprovincial and international boundaries, as works connecting one or more provinces or extending beyond the limits of the province. Works on international rivers might also be subject to the provisions of the Boundary Waters Treaty implemented under section 132 of the B.N.A. Act. Finally, of course, federal grants in aid may be used as an incentive for the construction of water supply systems.

Sewage Disposal

This, too, generally falls within provincial competence, subject to federal laws within its fields. Among the areas of federal competence that may be relevant there are federal laws against pollution, justified as criminal law or as laws relating to fisheries where sewage is dumped in streams.

Power Development

Power development generally falls within provincial responsibility. But it must be remembered that the provinces cannot interfere with the public right of navigation or federal laws respecting navigation, so federal permission will be required on navigable rivers. The federal parliament is also permitted to protect the fisheries, and thereby interfere with provincial power development.

The federal government has full discretion to use its lands as it wishes, so it could develop power on its own lands. It may also have jurisdiction over international and interprovincial rivers under the "Peace, Order and Good Government" clause. It certainly has jurisdiction, through the International Joint Commission, over certain obstructions on international rivers by virtue of the Empire treaty clause.

One head of jurisdiction that may give the federal parliament considerable scope over power development is that over works and undertakings connecting a province with another province or extending beyond the limits of the province. Even though the works used for power development may be wholly situate within a province, they may become connecting works by virtue of their relation to a power distribution system that is interprovincial or international in scope.

Finally, power works situate wholly within a province may be brought within federal jurisdiction by a parliamentary declaration that the work is for the general advantage. But the serious political problems this raises make it unlikely that it will be exercised unless, at least, there already is considerable federal involvement in a development - for example, a power development closely associated with a work for the improvement of navigation.

Irrigation

Irrigation would appear to fall within Section 95 of the British North America Act (the agriculture power) giving the federal parliament and provinces concurrent power. But federal legislation prevails in case of conflict. Thus, the federal parliament could authorize irrigation works depleting the flow of a river in such a way as to interfere with power development or municipal water supply.

Reclamation

Land reclamation, if for agricultural purposes, is subject to similar considerations as irrigation.

Recreation

Recreational uses of water also fall largely within provincial control, though this power must be exercised subject to federal regulation within its own sphere, particularly in relation to navigation and fishing. Moreover, in areas of the sea outside the limits of the provinces, federal legislation alone would apply.

Multi-Purpose Development

Multi-purpose development falls largely at least within provincial competence, though if navigation or fishing is involved federal participation will also be required. Reclamation for agricultural purposes would seem to fall within the concurrent power over agriculture. In other cases, even where multi-purpose development or reclamation extends to areas in two provinces, it still falls largely within provincial competence except where interconnecting works and undertakings are involved or the spending and declaratory powers are used.

Federal-Provincial Cooperation

Federal-provincial cooperation will on many occasions be required for a full and rational development of water resources. This can, of course, be done by concurrent action of federal and provincial authorities, each in its own sphere, even without any formal understanding. For example, a province may empower a company to build a hydro-electric power or other project in navigable waters, but permission to obstruct such waters must be obtained from the federal authorities.

Again, administrative convenience may dictate the use of a single official to enforce or administer both federal and provincial laws relating to the same subject matter. For example, a province may assign to federal fishery officers the task of enforcing the laws relating to provincially-owned fisheries. Such cooperation may also take place at a more highly developed level. Though delegation of legislative power between the federal parliament and the provincial legislature is impossible, it is possible for one level of government to delegate executive and administrative authority (including the making of regulations) to administrative agencies created by the other level of government, such as, for example, the federal delegation of powers to provincial motor carrier boards over extraprovincial carriers.

Cooperation between the federal and provincial governments may take place by the transference of all or part of one's control over public property. For each level of government has legislative and administrative power over its public property. One example of a partial transfer of such administrative authority is the delegation by some provinces to the federal authorities of the power to issue leases of oyster beds belonging to the provinces. A more far-reaching example is provincial expropriation of lands and their transfer to the federal government for the development of national parks.

3. WATERCOURSES

Classification

The rights relating to rivers, streams, lakes and other bodies of water may be divided under three heads: (1) public rights; (2) riparian rights; and (3) rights associated with ownership of the bed.

Public Rights

Classification

By public rights are here meant rights belonging to the public generally, not rights belonging to governmental bodies, though such bodies may, of course, own rights in the same way as individuals or private corporations. There are three public rights to water: (1) the right of navigation; (2) the right of floatability; and (3) the right of fishing.

The Public Right of Navigation

In England the public has a natural right to navigate in tidal waters, but though non-tidal streams may be *de facto* navigable the public has no right to navigate on them, except as authorized by statute or immemorial custom or unless the owner of the bed has dedicated the stream or other body of water as a highway. Courts in the Atlantic Provinces have for long assumed that the rule is the same there, but the point never appears to have been squarely raised. In other parts of Canada the rule is that if waters are *de facto* navigable, the public right of navigation exists there, whether the waters are tidal or non-tidal, and it is accordingly probable that the law of the Atlantic Provinces may be held to be the same as in other parts of Canada.

Whether the requirement that water must be tidal to be open to navigation by the public is accepted or not, it is not sufficient to give the public the right of navigation that the water be tidal; it must also be navigable in fact, though there is a *prima facie* presumption that if water is tidal it is navigable. The question whether water is *de facto* navigable is one of fact to be determined by an examination of all the circumstances of the case.

The right of navigation is similar to the public right of passing and repassing on a highway. It includes all rights necessary for the full enjoyment of this right of passage, such

as the right to pass, to anchor and to moor, and to remain for a reasonable time for loading and unloading. But the rights to anchor and to moor must not be taken to give a right to ground on the foreshore when water has receded or to moor at a private dock without the owner's consent. Public harbours have been set aside to enable persons navigating to land.

It must be underlined that the right of passage afforded by the right of navigation does not authorize the doing of acts inconsistent with the rights of the owner of the bed or of other persons except as may be necessary to its exercise.

The right of navigation is not extinguished by the formation of ice in winter, though it is, of course, rendered more difficult and sometimes physically impossible. Accordingly, navigation may be carried on by breaking or crushing the ice or cutting a passage through it, even though the ice belongs to the owner of the bed of the water, for the right of navigation is paramount. A person exercising such right must, however, do so with due regard for the rights of others.

All members of the public have equal rights to navigation, but each must do so in a reasonable manner so as not to interfere with the equal right of others. What is reasonable usually is dependent on all the circumstances of the case. It is evident that in enjoying the right it is permissible to interfere to some extent with rights of others, but such interference must be reasonable.

Finally it should be mentioned that the right is a paramount one; whenever it conflicts with the rights of the owner of the bed or of a riparian owner it will prevail. Still, the right has been interpreted so as to be capable of accommodation with other rights. Thus it must be reasonably exercised, and it requires more than negligible interference to convince a court that the right has been interfered with. Again, to a minor extent at least, other countervailing public benefits will be considered. A court would not, for example, enjoin the construction of a wharf if on balance it improves navigation at a port, and a similar approach may possibly be taken to a bridge over navigable waters.

Nothing short of legislation can take away the public right of navigation. Accordingly, a crown grant of the bed of a stream does not interfere with the right. It exists no matter who owns the bed. The federal parliament is the appropriate legislature to pass laws respecting navigation, and many provisions have been passed respecting the right. Among these is the Navigable Waters Protection Act, which requires the approval of federal authorities for the erection of works that may interfere with navigation, and provides for the removal of works built without such approval. It also establishes a procedure empcwering the Minister of Public Works to remove wrecks and other obstructions from navigable waters. Finally it authorizes regulations respecting ferry cables and swing and draw bridges.

The Public Right of Floating

Somewhat similar to the right of navigation is the public right to float logs and other property on navigable and floatable streams. There is no general right of floating in England, but from economic necessity New Brunswick courts developed the right. The courts of Newfoundland also recognized a similar right, but the common law was not developed there because general legislation was passed recognizing the right, and there are a substantial number of statutes giving a right to float to various companies as well. In Nova Scotia, the right was created by statute, but the statute was repealed by the Water Act of 1919. Replacing this general right of floating is a procedure in Section 3 of the Water Act whereby persons may be authorized by the Minister of Finance and Economics to use watercourses for such purposes and on such terms and conditions as are deemed proper, including terms that the person so authorized shall compensate any person whose rights may be injuriously affected. Other provisions give many of the subsidiary rights developed at common law in New Brunswick. There are also a number of other Nova Scotia statutes giving particular rights or affecting certain aspects of floating. The right was never developed in Prince Edward Island. The following discussion is, in strictness, applicable only to New Brunswick, but the general statutory right in Newfoundland is very similar, and subject to modifications made in granting particular rights, it would have considerable relevance to Nova Scotia.

A floatable stream is one that is not navigable in the strict sense but is navigable by canoes and other small craft and is capable of floating logs and other property. A stream capable of being so floated is subject to the public right of floating. Whether a stream is or is not floatable is a question of fact.

To give the public the right to float, it is not necessary that a stream be floatable at all times; the right may exist even if it only has the capacity to float at freshet times. Probably, too, like the statutory right in Newfoundland, the New Brunswick courts might hold that the public right exists when a stream is made floatable by penning water back for a time by means of a dam, at least where the stream is floatable at certain times. In any event it is clear that in exercising the right to float, a person may go on riparian land when necessary to remove logs that have been cast on the shore.

As in the case of navigation, all have equal rights to passage for their logs and other property, and so each person exercising the right must act with due regard for the similar rights of others. Unlike the right of navigation, however, the right to float is not paramount; it does not prevail over the rights of the owners of the bed and bank but is concurrent with them. One who floats logs or other property down a stream must do so in a reasonable manner interfering as little as possible

with the rights of landowners along the stream, and if he injures the property of a landowner the onus is on him to show that his conduct was reasonable.

Riparian owners must on their part exercise their rights so as to hinder as little as possible persons floating logs on the stream. For example, a person who owns the bed of a stream has a right to dam the stream, but if it is floatable he is under an obligation at common law to provide sluiceways or other reasonable means to allow logs and timber to pass. Obviously, however, the exercise by a landowner of his right to build a dam will affect the flow of the water and consequently log driving operations. It follows from the fact that the rights to build a dam and to float are concurrent that a person driving logs must submit to a reasonable measure of inconvenience and expense resulting from the altered flow of the river resulting from the erection of the dam.

If the right of passage on a river is blocked, a person driving logs may remove the obstruction as in the case of any other public nuisance if he suffers thereby. But he is not justified in removing the obstruction unless it does obstruct him.

The Public Right of Fishing

The public has a right to fish in all tidal waters. Accordingly the grant of land over which tidal water flows does not automatically carry with it the exclusive right to fish as it does in fresh water. In fact, since Magna Carta the Crown has no power apart from statute to grant a several (or exclusive) fishery in tidal waters either to the owner of the land or to anyone else. Since Canada was not settled before then, there cannot be a several fishery in tidal waters in the parts of Canada governed by common law except by statute.

In England, the public right of fishing is limited to tidal waters, and though there are statements that the right in Canada may exist in non-tidal waters that are navigable or whose bed belongs to the Crown, the weight of authority is that the law is the same in Canada.

The public right of fishing does not extend to fishing by means of kiddles, weirs and other instruments fixed to the soil. Such methods of fishing involve a use of the bed which under English law is vested either in the Crown or a private owner. If the soil is to be used in this manner, the permission of the owner must be obtained. This can give rise to duplication of administration at the federal and provincial levels, for example in connection with lobster fishing.

The public right of fishing must be exercised reasonably having regard to the same rights of other people and to the

public right of navigation and private rights. Ordinarily, the reasonable exercise of the public rights of navigation and of fishing can be exercised concurrently, but where it becomes impossible to exercise both rights concurrently, the public right of navigation is paramount and will prevail.

The public right of fishery is regulated by numerous federal statutes.

Riparian Rights

Introduction

The owner of land adjoining a river, stream or lake has certain rights respecting the water therein whether or not he owns the bed. These rights arise from his ownership of the bank, and from the Latin word for bank, ripa, they derive their name of riparian rights. The owner is similarly referred to as a riparian owner.

The riparian rights may be classified under the following heads:

1) the right of access to the water;
2) the right of drainage;
3) rights relating to the flow of water;
4) rights relating to the quality of water (pollution);
5) rights relating to the use of the water; and
6) the right of accretion.

The Right of Access

The most basic of the riparian rights is the right of access to the water; for without it a riparian owner could not enjoy the others. The right of access is a property right, and the owner may, therefore, maintain an action or obtain an injunction against anyone, even the owner of the bed or the Crown, who interferes with the right. These remedies are not restricted to the absolute owners; whoever lawfully occupies riparian land - for example, a tenant - may bring an action to enforce it.

The right includes access to and from the water. On the sea and in other tidal waters this involves the right to go on the shore, i.e., the land between high and low water mark, for the purpose. And a riparian owner has a right of access over the shoal waters of a lake to the deeper waters where navigation practically begins.

The Right of Drainage

There is a right in owners of land adjoining a natural stream to drain their lands in the stream even though this must affect the flow downstream, but the exact extent of the right is still somewhat obscure. In the first place it is not clear whether the right is limited to riparian owners or extends to other landowners as well. Again, it is not settled to what extent a landowner in draining his land must concern himself with its effect on land downstream, though it is clear that the right must be exercised reasonably.

Rights Respecting Flow

General

A riparian owner is entitled to certain rights respecting the manner in which water reaches and leaves his land. He is, first of all, entitled to have the water flow down to his land as it has been accustomed to flow, substantially undiminished in quantity and quality, subject to the rights of other riparian owners to use the water, and to the public rights of navigation and floating.

A riparian owner is also entitled to have the water leave his land without obstruction. Moreover, non-riparian owners are also protected from the use of water that may damage their lives or property by flooding or otherwise.

The various riparian rights relating to flow may conveniently be classified as follows:

a) the right to have the water flow in its natural course;
b) rights preventing the permanent extraction of water from the stream;
c) rights preventing the alteration of the flow to property downstream;
d) the right to have the water leave one's land in its accustomed manner.

Flow in Natural Channel

A riparian owner is entitled to have the water flow down the stream to his land along its regular channel. This being a proprietary right, anyone who diverts the water from its regular course may be restrained from doing so without proof of damage, actual or apprehended. A riparian owner may, however,

alter the course of a stream on his own land, so long as he returns it to its normal channel without affecting the flow downstream.

Diversion and Extraction

Closely related to the diversion of the course of a stream is the permanent diversion or extraction of water from it. Here the rule is that the water must be returned to the stream substantially undiminished in quantity and quality. Accordingly, one who diverts water for the purpose, for example, of irrigating his land, must do so without sensibly diminishing the flow of the water downstream.

Alteration to Flow

A use of water may not alter the total flow downstream, but affect the nature of the flow, by altering the times when the river will flow, by increasing or decreasing the rate of flow, or otherwise. Such action by an upstream owner may, of course, be detrimental to a downstream owner. Consequently if the principle, that a riparian owner is entitled to have the water flow to his land in the manner in which it has been accustomed to flow, is interpreted strictly, the upper riparian owner would be highly restricted in the use of the water. The maintenance of a dam, for instance, would be almost out of the question on many streams. Accordingly, the courts have made clear that a riparian owner is entitled to the reasonable use of water in a stream on or adjoining his land, and in making such use they recognize that he must in many cases of necessity affect the flow dowstream, even if the lower riparian owner does suffer appreciable injury.

Water Leaving Land

A riparian owner has a right to have water leave his land without obstruction. The most frequent source of obstruction, of course, are dams penning the waters back. The owner of the bed is entitled to build a dam thereon, but if it obstructs the flow from an upper owner's land he may bring an action for damages or an injunction. The damage to warrant an action for damages or an injunction may be very slight, so long as it is not negligible. Otherwise the lower riparian owner might acquire prescriptive rights to back the water up, preventing the upper owner from later making use of the land as he would otherwise have been able to do.

Damages Irrespective of Riparian Rights

Damages from the use of water have been discussed in the context of the riparian owner's rights to the natural flow of the stream. But the cases must be examined in the context of a broader principle applicable to both riparian and non-riparian owners. That principle is this: any person who interferes with the course of a stream has the duty to see that the works he substitutes for the natural channel are adequate to carry the water brought down even by an extraordinary rainfall, and if damage results from the deficiency of the substitute he is liable. The cases are also often dealt with in terms of the rule in Rylands v. Fletcher: that he who for his own purposes brings on his land anything likely to do injury if it escapes is, subject to certain exceptions, liable for all damage that is the natural consequence of its escape. Accordingly, if water is penned back by a dam so as to flood the land of another, whether that other is a riparian owner or not, the owner of the dam is liable. The same is true if a dam is suddenly opened causing flooding or other damage downstream. The rule in Rylands v. Fletcher is subject to two exceptions. Liability does not accrue for an act of God (i.e. an accident resulting from natural cause that could not have been prevented by reasonable care) or malicious actions of a third person.

Prescriptive Rights

A person may, of course, enter into a contract with another permitting him to increase or decrease the flow of water in a stream, or to overflow the other's land or otherwise interfere with the latter's rights. Such contracts may create personal obligations between the parties only. But it is possible to create rights respecting the flow or penning back of water that runs with the land (both the land to be benefitted and the land upon which the burden rests). Such rights are called easements. For example, it is possible for the owner of the bed of a stream to acquire an easement to overflow the land of an upstream owner by means of a dam; such right then continues no matter who owns the land benefitted or burdened. These rights may exist under contract, but they may also be acquired by prescription from long use.

Pollution

At common law a riparian owner is entitled to have water reach his land substantially undiminished in quality. Even in the absence of damage, therefore, he has an action against anyone who pollutes or otherwise materially alters the character of the water.

Generally speaking, a person who is not a riparian owner has no claim against another for polluting a stream unless the pollution creates a nuisance. To constitute a nuisance the act complained of must be such as to interfere substantially with the enjoyment of a person's land. What amounts to a substantial interference is measured by ordinary modes and standards of everyday living, not fanciful and fastidious ones. For example, a foul smell emanating from a river polluted by waste from a kraft mill may amount to a nuisance.

Uses of Water

A riparian owner does not own the water in a running stream, but he may make use of it as it passes his property. The extent of his rights depends on whether the use may be classified as an ordinary or an extraordinary use.

Ordinary uses are restricted to the use of water for drinking purposes, watering stock and other domestic purposes, such as washing. If in making use of water for ordinary purposes, a riparian owner completely exhausts the supply, he is not liable to a lower riparian owner.

A riparian owner may also make use of the water for extraordinary purposes. What amounts to an extraordinary purpose will depend on the general conditions in the area and the uses to which the stream has previously been put. A common example is the use of water for running a mill. Another is irrigation. Unlike a person who uses water for ordinary purposes, one who uses it for extraordinary purposes must restore it to the stream substantially undiminished in quantity and quality. There is no right of first appropriation. But the use of water for extraordinary purposes will frequently interfere with the manner in which it reaches land lower down the stream. If, for example, a riparian owner dams a stream, its flow will periodically be interrupted. For injury so caused he is liable if, having regard to all the circumstances, he has acted unreasonably.

A riparian owner's right to use water is subject to the similar rights of other riparian owners, to the public rights of navigation, floating and fishing, and to the rights of the owner of the bed.

Accretion

The owner of land bounded by any body of water is entitled to any extension of land on the side of the water arising by accretion. There are two types of accretion. One is created by the gradual and imperceptible deposit of alluvium on the banks of a riparian owner's land. The other results from

the gradual and imperceptible recession of the waters to a lower level. In either case, the additional dry land belongs to the adjoining owner. Correspondingly the gradual erosion of the land or the encroachment of the water upon it will vest the ownership of the land thus covered with water in the owner of the bed. Accretion and erosion will also affect ownership where the riparian owner owns to the centre of the stream, for that line will vary as the river changes its course.

To give rise to an accretion, the change must take place gradually and imperceptibly. And the same is true of an erosion. Thus avulsion or irruptions, or the sudden changing of the course of a river as a result of a flood, freshet or the breaking of a dam or other violent changes, do not change the ownership of land.

Ownership of the Bed

Riparian rights arise by virtue of the ownership of the bank of a stream, but many of these rights cannot be effectively exercised without owning the bed or having the permission of the owner to use it. For example, a dam is, in many cases, required to make use of water.

The owner of the bed of a body of water in general has the same rights in it as any other landowner. He owns everything forming part of the land, such as sand and gravel, and everything above or below the land, except game and fish (which must first be appropriated) and water which at common law does not form the subject of ownership. And though he does not own game or fish until it is appropriated, he has the right to hunt fowl or fish over his land subject, of course, to game and fisheries laws; these rights are exclusive, except that in tidal waters the public right of fishing exists.

Since he has generally the same rights as other landowners, the owner of the bed may erect anything thereon, and the owner has the right to the water power on it. But the right of the owner of the bed of water to build on his land is subject to the public rights of navigation, floating and fishing and to the rights of other landowners on and along the stream or lake. The mere fact, however, that a person is lawfully on waters exercising a public right - for example, navigation - does not permit him to exercise rights vested in the owner of the bed, such as shooting or fowling.

Frequently in a grant of land on or adjoining which there is a stream or body of water, no specific mention is made of the water or its bed. A number of _prima facie_ rules have been devised to determine whether the bed is included in the grant. The rule to be applied depends on the nature of the body of water. If it is tidal, whether it be the sea or a tidal river, lake or stream, a grant of land adjoining the water _prima facie_ extends

only to ordinary high water mark. Where it is non-tidal, the presumption is that a grant adjoining a stream extends to the centre thread of the stream. Both these presumptions may be rebutted by showing a different intent.

Statutory Alterations

In all the provinces serious alterations have been made to riparian rights and the rules relating to the ownership of the bed, both by general and special statutes. Only the most important of the general statutes can be mentioned here.

In New Brunswick, the major statutory provision affecting riparian rights and ownership of the bed is Section 60 of the Crown Lands Act and its predecessors. The first such section was passed in 1884. It reserved from Crown grants a strip of land along certain rivers in the north of the province, so that in grants near those rivers the riparian rights and ownership of the bed remained in the Crown. The provision was later extended to apply to all grants along streams and lakes. The Water Act, which gives the New Brunswick Water Authority considerable control over the flow and pollution and use of waters, may also be mentioned.

In Prince Edward Island, the Water Authority is also given considerable power to control the flow and pollution of water.

In Newfoundland since July 1, 1967, ownership of the beds of water is vested in the Crown, unless it had already been granted. Moreover, since 1884 there has been a provision in the Crown Lands Act providing for the reservation from Crown grants of a strip of land on each side of a river or lake.

The common law relating to watercourses is fundamentally altered in Nova Scotia by Section 2 of the Water Act, which vests in the province, with minor exceptions, every watercourse and the sole and exclusive right to the water therein, as of May 16, 1919; and every watercourse is freed from all estate, right and privilege whatsoever from that day. This is so notwithstanding any previous law or grant. The Minister of Finance and Economics is authorized to permit any person to use watercourses and their waters for such purposes and on such terms and conditions, including the payment of compensation, to any person whose rights may be detrimentally affected. This gives the Minister a very broad control over the water resources of the province.

It is not possible here to examine the many statutes affecting the law of streams and lakes, but something must be said of the courts' approach to these. Generally, statutory powers are interpreted so as to interfere as little as possible with the common law and proprietary rights of others. Moreover,

if a work is authorized, it must be executed without negligence, and negligence includes so constructing a work that it causes damage where this could have been prevented by a reasonable exercise of the powers. However, if a person is authorized to do something by statute, and it is properly done, he is under no liability to anyone who suffers injury thereby unless a remedy is provided by statute.

4. INTERNATIONAL RIVERS

In addition to the rivers, streams and lakes wholly situated within one of the provinces, and the interprovincial rivers, there are two international river systems in the Atlantic Provinces: the Saint John River system and the St. Croix River system.

International rivers are, of course, subject to the law of the provinces, states and countries where they flow. In the case of the St. Croix this includes the applicable law of New Brunswick and Maine and of the Parliament of Canada and the United States Government. The Saint John River is subject to all of these as well as the law of Quebec; moreover the Saint John River is an interprovincial as well as an international river, and this may raise additional complications. The laws of Quebec, Maine, and the United States will not be examined here, but it may be mentioned that the underlying structure of the law in both Quebec and Maine - riparian rights, ownership of the bed and public rights of floating, navigation and fishing - is rather similar to that prevailing in the Atlantic Provinces subject to varying degrees of statutory intervention as is the case in these provinces. The relevant law of New Brunswick has already been examined. Of the laws of the Parliament of Canada, only the International River Improvements Act will be given attention here. This will be followed by an examination of relevant international law.

The International River Improvements Act was enacted in 1955 to give the federal parliament jurisdiction over dams, canals or other works altering the natural flow and interfering with the actual or potential use outside Canada of water flowing from Canada to a point outside Canada. The Act prohibits, subject to certain exceptions, the construction, operation or maintenance of an international river improvement without a licence issued under the Act. An "international river improvement" is defined as a dam, obstruction, canal or other work whose purpose or effect is (i) to increase, decrease or alter the natural flow of an international river, and (ii) to interfere with, alter or affect the actual or potential use of the river outside Canada. An "international river" is defined as "water flowing from a place in Canada to any place outside Canada." The Act also authorizes the making of regulations respecting the construction, operation, and maintenance of international river improvements, and for providing a system of permits. This allows for administrative surveillance of such improvements.

The international law respecting the international rivers of Canada is largely governed by treaty. The Treaty of Peace of 1783 establishes the St. Croix River as part of the international boundary, and the actual boundary was settled by commissioners under the Jay Treaty. The Ashburton-Webster Treaty defines part of the international boundary as running in the middle of the Saint John River, makes navigation on the river

free and open, and provides for driving lumber from Maine on the Canadian side of the river.

But by far the most important treaty affecting the Saint John and St. Croix Rivers is the Boundary Waters Treaty, 1909. The treaty applies to all fresh water forming the boundary and streams crossing the boundary. It adopts a number of fundamental principles regulating the international waters of Canada and the United States and establishes the International Joint Commission, a body possessing wide judicial, investigative and administrative powers. The treaty was implemented by Canadian legislation and by the United States Constitution, and so forms part of the domestic law of both countries.

The first principle established by the treaty is that the navigation of all navigable boundary waters is to be forever free and open for the purpose of commerce to the inhabitants and ships of both countries equally. "Boundary waters" are defined as the waters from main shore to main shore of the lakes and rivers and connecting waterways, or the portions thereof, along which the international boundary passes, including all bays, arms and inlets thereof, but not including (1) tributary waters which in their natural channels flow into such rivers, lakes and waterways, (2) waters flowing from such rivers, or (3) waters of rivers flowing across the boundary. Boundary waters, therefore, include the portions of the Saint John River constituting the international boundary and the waters of the St. Croix, the Chiputneticook Lakes and Monument Brook, and where these are navigable, they are open to navigation by the inhabitants and vessels of both countries on either side of the border. Some of the waters of the Saint John and St. Croix River systems fall within the first exclusion, but the most important of these excepted waters are those flowing across the boundary. The principle of free navigation over boundary waters is made subject to any laws or regulations of either country, within its own territory, not inconsistent with the principle and applying equally and without discrimination to inhabitants and vessels of both countries.

The treaty establishes a number of other principles relating to boundary waters. Thus it provides that each party on its own side has equal and similar rights to their use, but the following order of precedence is to be observed: (1) uses for domestic and sanitary purposes; (2) uses for navigation, including the service of canals for the purposes of navigation; (3) uses for power and for irrigation purposes. However, these provisions are not to apply to or disturb existing uses of boundary waters. Other principles relating to boundary waters are inextricably tied to the powers of the International Joint Commission, to which attention will be given later. Before doing so, however, we must turn to the principles governing waters flowing across the boundary or into boundary waters.

Turning to the transboundary waters, the treaty adopts the Harmon Doctrine, that a state may do as it pleases with the

water in its own territory, without regard to downstream benefits. This applies to the Saint John River and some of the tributaries of that river and of the St. Croix River. Since Maine is upstream, it is consequently in a favourable legal position. There are, however, qualifications to the Harmon Doctrine as adopted in the Boundary Waters Treaty. In the first place, the right is made subject to pre-existing treaties so that the rights of navigation and floating accorded by the Ashburton-Webster Treaty cannot be interfered with. Secondly, each country retains the right to object to any interference with, or diversions on the other side that would be productive of material injury to the navigation interests on its side. This, of course, may not really advance the legal position at all unless, as is possible, a tribunal reads into this an exception to the Harmon Doctrine in favour of navigation.

Thirdly, the exclusive jurisdiction given to each party over transboundary waters on its own side is limited by a provision providing that boundary waters and waters flowing across the boundary shall not be polluted on either side to the injury of health or property on the other. Finally, it is provided that any interference with or diversion from their natural channel of waters flowing across the boundary or into boundary waters on either side of the boundary shall give rise to the same rights and entitle the injured party to the same legal remedies as if such injury took place in the country where such diversion or interference occurs. The clause has been the subject of considerable controversy, but the probability is that it imposes a duty on each country to provide a legal remedy for diversions on its side that cause injury on the other side, and that it applies to Canada, the United States and their provinces and states as well as individuals.

Another matter closely related to the exclusive jurisdiction and control of the upstream state over transboundary waters is downstream benefits resulting from upstream storage. Upstream storage may give rise to benefits downstream in several ways. In particular, by regulating the flow of water a greater amount of continuous hydro-electric power may be produced downstream. This is particularly important on the Saint John River because the most appropriate site for upstream storage for the development of hydro-electric power on the river is in Maine. While the principles developed in relation to one river cannot be applied without modification to other rivers, it seems fair to say that the experience on the Columbia River suggests that downstream benefits on the Saint John River resulting from upstream storage in Maine would entitle Maine to expect compensation. This compensation, in relation to increased power produced in New Brunswick, would be equal to half such increased power (or if Maine, New Brunswick and the federal governments agreed, a money compensation based on the value of such power).

In addition to defining a number of principles governing international waterways, the Boundary Waters Treaty also established the International Joint Commission composed of six

commissioners, three from Canada and three from the United States; each national section has its own chairman and secretary.

We must now examine in more detail the powers of the Commission that are relevant to the Saint John and St. Croix Rivers in respect of which they have been exercised on numerous occasions. Article III deals with boundary waters and so applies to the whole of the St. Croix, the Chiputneticook Lakes, Monument Brook and the part of the Saint John forming the international boundary. Under this Article, the parties agreed that, in the absence of special agreement between them no uses, obstructions or diversions of boundary waters affecting the natural level or flow of boundary waters on the other side of the line shall thenceforth be made except with the authority of the United States or Canada within their respective jurisdiction and with the approval of the Commission. In a word, each country has in relation to these uses on its side of the line limited its power, and that of its citizens, to act except with the approval of the Commission. Some exceptions are made to this, however. The Article does not limit the right of either government on its own side of the line to undertake or carry on governmental works for the benefit of commerce and navigation that do not materially affect the level or flow of boundary works on the other side. Another exception is that the Article is not intended to interfere with the ordinary use of such waters for domestic and sanitary purposes. In reading this clause, however, it must be remembered that Article IV absolutely prohibits the pollution of boundary waters, as well as transboundary waters, on one side of the line to the injury of health or property on the other. This prohibition however, does not come within the judicial powers of the Commission. Complaints regarding such pollution must be made to the government of the injured party which in turn may seek redress from the other government through diplomatic channels. The Commission may study the matter and make suggestions, but it has no authority to compel action.

Article IV provides that, in the absence of special agreement, neither party to the treaty will permit the construction or maintenance on its side of the boundary of remedial or protective works, dams or other obstructions in waters flowing from boundary waters or in waters at a lower level than the boundary in rivers flowing across the boundary, the effect of which is to raise the natural level of waters on the other side of the boundary unless such construction or maintenance is approved by the Commission. This Article is obviously applicable to the Saint John River.

Article VIII sets forth a number of rules or principles governing the Commission in adjudicating on matters falling under Articles III and IV. These provide for equal and similar rights of the parties in the use of boundary waters and for following the priority of uses already spelled out. But these provisions are not to affect pre-existing uses. The Article, moreover, gives the Commission important discretionary powers. It empowers the Commission to suspend the equal division of rights of the

parties to boundary waters in cases of temporary diversion along such waters where such equal division cannot be made advantageously because of local conditions and where such diversion does not diminish elsewhere the amount of water available for use on the other side. Again, where the elevation of the natural level of waters on one side of the boundary results from the construction or maintenance on the other side of remedial or protective works, dams or other obstructions in boundary waters, or in waters flowing therefrom, or in waters below the boundary in rivers flowing across the boundary, the Commission must require, as a condition of approval, that adequate provision be made for the protection and indemnity of all interests on the other side.

In exercising the powers under Articles III, IV and VIII, the Commission's decisions are final, subject only to the agreement of both parties. In addition, Article IX gives the Commission broad powers of investigation at the request of either government. It provides that either government may refer to the Commission any matters of difference involving rights, obligations or interests of either country in relation to the other or its inhabitants, and the Commission is authorized to examine and report thereon. Unlike decisions under the previous Articles, however, the Commission's reports under Article IX are mere recommendations. In practice all references under the Article have been joint references by both countries. Finally Article X provides that any other matter of difference may jointly be referred to arbitration before the Commission, but the procedure has never been used.

5. INTERPROVINCIAL RIVERS

The law of interprovincial rivers is relatively unexplored, and the following discussion does little more than identify the problems. As in the case of international rivers, there are rivers forming the boundary and rivers that flow across the boundary. Boundary rivers give rise to similar problems as transboundary rivers, the major problem peculiar to boundary waters being the location of the boundary. Various instruments provide that the Restigouche River forms part of the New Brunswick-Quebec boundary, the Missiquash and the Tidnish Rivers form part of the New Brunswick-Nova Scotia boundary and the Romaine River forms part of the Labrador-Quebec boundary.

Perhaps the easiest way of discussing the legal problems relating to transboundary rivers is to pose a series of hypothetical situations in increasing orders of complexity. The simplest case is that of a landowner without statutory authority building a dam or other works or polluting water in one province to the detriment of a landowner in another province down the stream, or the converse case of a landowner in a downstream province without statutory authority building a dam causing water to be penned back to the damage of a landowner in a province upstream. These situations raise two principal issues: (a) what is the applicable law? and (b) in what court may the injured party sue?

Turning to the first question, some writers suggest that the doctrine of riparian rights would apply, while others think the courts would divide the rights on the basis of principles of equitable apportionment such as those developed in the Supreme Court of the United States. The former view seems more likely to be followed.

The question of the appropriate court has been raised in a New Brunswick case where it was held by a majority that the appropriate court was in the province where the harmful effect took place, not in the province where the act that caused it was done. The case has, however, been criticized as inconvenient, since no injunction could be obtained against the wrongdoer.

Further problems arise where there is statutory intervention. Suppose a province by statute authorizes the doing of something within its territory that affects the flow or quality of water in another province. Some writers argue that a province cannot legislate so as to affect riparian rights in another province, though others doubt this. Still others think the province would in legislating be subject to a doctrine of equitable apportionment.

If a private individual or organization were authorized by a provincial statute to undertake in the province a development on an interprovincial river, a person whose riparian rights in another province were detrimentally affected would raise

similar problems as those raised if there had been no statute authorizing the development. But, in addition, the consitutional validity of the statute would be raised.

Similar considerations would apply where provincial lands were affected. But quite apart from its proprietary interests, a province has an interest in seeing that development of an interprovincial river in another province does not detrimentally affect water or its use within its territory, even where its own land is not affected. The writers who have dealt with the matter are all agreed that such questions cannot be judicially determined, in the absence of agreement between the provinces, because there is no constitutional provision for the judicial settlement of interprovincial disputes. It might be added that Section 30 of the Exchequer Court Act provides a forum for the judicial settlement of federal-provincial disputes, but it does not set forth the applicable rule.

The federal parliament may certainly make legislation affecting interprovincial rivers under specific heads such as navigation and shipping and fisheries, but it is also probable that it may legislate generally respecting the matter under the "Peace, Order and Good Government" clause. Assuming this is the case it is conceivable that the province, too, may legislate respecting such rivers, subject to being overridden by federal legislation.

6. SURFACE WATERS

Natural Drainage Principle

The starting point for any discussion of the rights and liabilities arising in respect of the flow of surface water is the natural drainage principle. This principle recognizes that higher land may drain onto lower land through the forces of nature without giving a cause of action to the holder of the lower land for injury resulting from the flow. The law does not impose an obligation on the holder of land to construct a system of drainage to prevent the natural flow of surface water from encroaching on adjoining property. On the other hand, the fact that the holder of higher land has no drainage obligation does not vest in him the right to have his land drain naturally onto lower land; the common law position is that natural drainage may be repelled. Nor does a right to the continuous flow vest in the lower landholder. A right to drain naturally cannot be prescripted; the mere passage of time will never confer upon a higher landholder an absolute right to demand that his land continue to be drained through the lower land, or upon a lower landholder a right to demand that he continue to receive the flow.

Right of Appropriation

Surface water within the boundaries of any property may be appropriated by the holder of the land without incurring liability to owners of land through which the water has previously flowed, or through which the water would have flowed had it not been appropriated. Moreover, a landholder's right to appropriate surface water may be exercised regardless of any reliance by a lower landholder upon the use of the water for irrigation or other purposes.

Liability for Artificial Diversion

Surface water may not be diverted across adjacent lands by means of artificial structures, and an attempt to transfer it by this process from one place to another via the land of another person will be actionable.

A person who constructs ditches, drains or culverts for the purpose of diverting water into adjacent lands may be sued by his injured neighbour for damages, or may be made subject to an injunction restraining his action where it is of a continuing nature, or both, whether the construction is effected by the owner or occupier of the land, or by someone else with his consent.

Similarly, any enlargement or deepening of a natural depression in the surface of the land so as to facilitate the flow of water onto adjacent property is actionable: here, however, it is relevant to determine whether the excavation amounts to an interference with the natural state of the land, so as to be classed as an actionable diversion, or whether it amounts to a restoration of the land to its natural state. In this connection, it is clear that one may remove an adventitious obstruction to the natural flow, such as a beaver dam, even if such removal causes the surface water to resume a long - deferred passage over adjacent property: it is possible that a landholder may even remove soil which has drifted into a natural runway of water, notwithstanding that to do so would increase the flow across neighbouring land, if in doing so, he is merely restoring the land to its natural state. A qualification to this right, however, is that the adventitious obstruction may not be removed where another party, relying on the continuance of the obstruction, has dealt with his land in such a way that he would be injured by the removal of the obstruction.

It is important to point out, however, that, technically, liability for the diversion of surface water is restricted to the extent that it constitutes an interference above and beyond that inconvenience or injury which would be caused in any event by the normal flow of the water.

The common law places an obligation upon a landholder, seeking to drain his land, to drain it in such a way as not to interfere with his neighbour's enjoyment of his land. Artificial drainage ways should be directed to existing natural watercourses when accessible. A landowner has a right to drain his lands into existing streams and rivers, though he must act reasonably. If he fails to do so and causes water in a natural watercourse to overflow, he may be liable to an action by riparian owners injured by the overflow.

Inasmuch as the artificial diversion of surface water gives a cause of action to the owner of the land across which the water is diverted, a failure on the part of that owner to take steps to prevent the diversion, either by private or legal means, for a period of longer duration than that limited by statute, may preclude him from complaining of the diversion, in which case a right to drain will be said to have been prescripted.

Obstruction of Flow

Every landholder has the right to obstruct the flow of surface water so as to keep the water off his land. He may, consequently, prevent surface water from passing across his property by creating artificial obstructions, notwithstanding that this may flood higher land in the line of flow or may interfere with a program of accumulation undertaken by another owner further down the line of flow. While there is conflict of opinion

this seems to apply not only where a flow of surface water spreads across the land, but also where it is confined in a natural channel such as a ravine or a natural depression in the surface of the soil.

Similarly the obstruction of a flow of surface water occasioned by topographical modifications or by the use and development of land is not actionable, notwithstanding that this may flood higher land in the line of flow or may interfere with a program of accumulation undertaken by an owner farther down the line of flow. The position appears to be wholly unaffected by such considerations as whether the use of land is reasonable or the motivation proper.

Regard for Rights of Others

Related to the matter of obstructing the flow of natural drainage is the question whether a person may prevent surface water from flowing across his land if the result is that the water flows across the land of an innocent third party not otherwise affected by the flow. There are two aspects to the problem - first, where the water is in fact diverted through the erection of an artificial obstruction to stop the flow, and, second, where the water is diverted by an obstruction created in the course of the use and development of the land.

Whether a landholder will be liable for injuries caused to adjacent lands not otherwise in the line of flow by surface water which is diverted as the consequence of an obstruction erected to prevent the flow from crossing his land appears to be dependent on his motives. Generally a man is liable for diverting surface water onto the land of his neighbour but there is reason to believe that this does not apply where the diversion is merely a consequence of an act *bona fide* done in the course of protecting his land against damage from a flow of surface water.

A landowner will not be liable for the obstruction of or diversion of surface water which is occasioned by the reasonable development of his land even though injury is thereby inflicted on the land of an innocent third party. The first problem arising here is whether a landholder is entitled to raise the level of his land, so as to render it better fit for use and development, where the consequence of raising the level of the land is to obstruct the flow of surface water before it reaches his land and to divert it across adjacent property not formerly in the line of the flow. To a great extent the solution to this problem rests in the considerations raised in dealing with obstruction by protective barriers. The answer seems to be that if the use of land is reasonable, is done with a view to preventing surface water from reaching the property, and is done in such a way as to avoid unduly casting the water upon adjacent property, it is not actionable.

Of greater difficulty is the question whether liability attaches to a landholder who, in altering his land or in constructing upon it, changes the natural drainage pattern of surface water collecting on his land. Generally speaking, if it represents a reasonable use of the land, and is carried out with normal skill so as not unduly to permit water to accumulate and overflow onto neighbouring property, no liability will attach in respect of a modification of the natural drainage characteristics of the land.

It appears that a landholder will rarely be absolved from liability where alteration of the land results in the accumulation of water which subsequently spills onto adjoining property, or results in the direct deflection of water onto adjoining lands. In these situations the common law seems to have placed a duty upon the landholder to take reasonable steps to obviate such injuries. A use of land is not natural or usual where steps are not taken to abate an unreasonable risk of injury to neighbouring lands.

It is apparent that a flexible approach must be taken to these problems. All the circumstances of the situation must be looked at closely to ensure that a reasonable and just result is reached. Common sense and experience will necessarily govern the application of the principles outlined above, reference being had to the usual practices of reasonable men in similar circumstances. One area of land development in which it is perhaps possible to project liability is that of land reclamation. In the absence of statutory immunity attaching to a land reclamation project, acts which involve either direct drainage onto adjoining lands, or the displacement of water through the raising of the surface of the land, so as to effect a general rise in the water level on adjoining lands, will probably entail liability for injuries inflicted on adjacent lands. While land reclamation may be a perfectly natural undertaking, it is incumbent on a person seeking to reclaim land to make adequate provision for the drainage of the accumulated surface water so as to avoid injury to adjacent land.

Liability for Escape of Stored Water

The accumulation and storage of surface water upon land places a high degree of responsibility upon the landholder to see that the water does not escape and cause injury to adjoining property. Where the escape of water is gradual so as to constitute a substantial and continuing encroachment on an adjoining landowner's right to use and enjoy his land, an action in nuisance may be brought by that owner to have the interference curtailed by injunction, as well as to recover damages for any injury occasioned by the escape. Where the escape of water is caused by the negligent behaviour of the landholder storing the water, or his servants, an action in negligence may be brought to recover for any injury occasioned to adjoining lands.

In many cases the circumstances are such that injury is caused by a sudden, unexplained escape of water. To meet this situation the courts developed the principle expounded in the English case of Rylands v. Fletcher that a person who lawfully brings on his land something which, though harmless while it remains there, will naturally do mischief if it escapes from his land should bear the responsibility for loss occasioned by the escape. But not every use of land brings the principle into play; it must be one of special danger, not an ordinary use.

The question, accordingly, is this: when is the storing of water on land a non-natural and dangerous use within the meaning of the rule? It has been held to be a natural use of land to bring water into a house for domestic uses, and into a commercial building for normal purposes. On the other hand, it has been held to be a non-natural use to bring water into property under pressure or to store water in bulk. The rule has also been applied to artificial drainage flowing across land with the owner's permission, and ultimately escaping so as to cause injury to lower land. It has further been held that the establishment of a sewage lagoon beside a frequently - cropped marsh is a non-natural use of land rendering a municipality liable under the rule for damage caused by escaping effluent. The indications are, then, that water stored on land for purposes of utilization or redistribution will come under the rule.

The problem of defining non-natural user is seemingly bound up in the concept of risk. It is a non-natural use of land to create a high degree of risk of injury to neighbouring property. The use will be classified as non-natural or natural depending upon the extent to which the particular circumtances of the case mitigate the risk of injury. At the same time, however, regard must be had for the fact that community development may be of significance in determining what may be classed as a non-natural use of land. Where water development projects attain acceptance as playing a functional role within the community, it may well be that use of land for these purposes will no longer be regarded as non-natural. And where sizable public benefits can be seen to flow from such projects, public policy may conceivably favour a shifting of the risk of loss away from the landholder who has undertaken the project, onto the injured party who has accepted the benefits of the project. In effect, then, the evaluation of the risk factor involves the delicate process of balancing the various interests affected.

The principle applies to things naturally on land, if the landowner has artificially accumulated them there and their escape does more mischief than they would otherwise have done.

A few other points pertaining to a claim under the rule in Rylands v. Fletcher must be mentioned. First, liability attaches only in respect of an escape from land within the control of the defendant onto neighbouring property outside his control, not to injuries incurred within the confines of his land. Secondly, absolute liability does not attach where the

damaging substance is accumulated on the defendant's premises with the consent of the injured party. Finally, the rule does not apply where the damage is caused by an act of God or the malicious act of a third party.

Right to Restrain Pollution

The general rule is that if a person pollutes surface water flowing across his land onto his neighbour's property, the latter may maintain an action for whatever damage is caused by the pollution either in respect of the land itself or in respect of his ability to use the water.

Statutory Modifications Respecting Surface Water Law

Apart from statutes dealing with federal lands, there are only a few federal statutes relating to the flow or pollution of surface waters. There are numerous provincial statutes relating to these questions, however. Various municipal and other drainage provisions may be mentioned along with statutes relating to pollution and public health generally. The effect of the various Water Acts may also briefly be mentioned. In New Brunswick the Water Act gives the Water Authority control over the use of all surface and ground water and the allocation of the use of water. But the vagueness of the provision and the total absence of criteria for control make it difficult to say to what extent the Authority may thereby vary common law principles. On the other hand, the power given by the Act to the Lieutenant-Governor in Council to make regulations to carry out the provisions of the Act may well be broad enough to enable a structure for the control of specified uses of water. A similar situation obtains in Prince Edward Island. In Newfoundland, general regulation and control of surface and ground waters is provided by the Water Resources and Pollution Control Act. By this Act the property and the right to the use and flow of surface and ground waters is declared to be vested in the province. Similarly in Nova Scotia the Minister of Finance and Economics is given control of the use of all surface, ground and shore waters as well as the power to designate how the water is to be allocated.

7. GROUND WATER

The designation "ground water" applies to water that collects, flows or percolates beneath the surface of the land. For most purposes, ground water is classed with casual surface water, and the same rules apply to the extent that they are applicable. However, different legal problems relate to the two classes of water. Problems relating to surface water are to a great extent nuisance-oriented; at issue is liability for damage occasioned by diversion. Problems relating to ground water, however, to a great extent are resource-oriented; at issue is liability for an interference with one's right to use the water. The explanation probably lies in the fact that, historically, ground water has played a more prominent role than surface water in fulfilling basic needs of both a domestic and an industrial nature.

A further observation is that the foundation for the law respecting ground water was laid in an age when both hydrology and geology lacked the degree of sophistication and acceptance achieved today. A general ignorance of natural processes beneath the surface of the ground has dictated legal rules that are still applicable today and that take into account, primarily, only that which is cognizable with the naked eye from a surface perspective.

English common law appears to have articulated only two classifications within the broad category of ground water. These are percolating waters and underground streams. The general rule is that there is no difference between the legal incidents of a stream flowing beneath the surface of the land and one flowing across the surface; riparian rights attach to both.

On the other hand, where subterranean water does not flow in a definite underground channel, but merely oozes through the soil, or collects in underground accumulations beneath the surface, the holder of overlying land has the same right to appropriate the water as he does in respect of surface water collecting on his land, notwithstanding that the water may have oozed through adjacent properties prior to accumulating beneath the surface of the landholder's property, and notwithstanding that the appropriation may interfere with some long established use of the water by some other landholder. The rule is not limited by a doctrine of reasonable user.

The abstraction of percolating water over a long period of time does not give rise to the existence of a right to restrain interferences on the part of adjoining landholders. But while a right to receive percolating water cannot be prescripted in an absolute sense, it can be the subject of an easement, which, in general terms, is a right to enjoy the use of another person's land for purposes beneficial to oneself. For example, a landholder may acquire by grant or prescription a right to enter

upon and take water from a well on his neighbour's land.

A landholder has a right of action for damage occasioned by the removal of lateral support naturally given by adjacent soil. He does not have, however, a similar right to support by subterranean waters, even where they lie beneath his own lands. If a landholder abstracts ground water, thereby causing a subsidence of adjacent lands, no action lies unless he does so with intent to damage his neighbour's land.

The development of ground water resources entails exploration with a view to discovering the locality and extent of subterranean accumulations. To a considerable degree, this involves entering upon private property and interfering with the use and enjoyment of land by landholders. This cannot be done as of right; it requires the consent of the owner of the property. Unless altered by statute, such as those relating to mines and minerals which create public ownership, establish a licence structure and provide for compensation, exploration will be carried on under private lease or licence, and compensation for injury will be covered by the ordinary principles of landlord and tenant law.

Pollution of subterranean waters causing damage to the overlying landholder is actionable on the same basis as the pollution of casual surface water. Where the pollution of ground water is occasioned by a direct act or a negligent act resulting in a pollutant being carried into the water, a cause of action arises. And where the use and development of land results in the pollution of ground water to the extent that it constitutes a nuisance to an adjacent landowner, normally an action will lie. In other situations, however, liability is not so clear. For example, if a landholder (or a municipality) were to appropriate such a large volume of percolating water that a drop in the water level in a neighbouring well resulted, allowing it to become contaminated, it is difficult to see that he would be liable; he is merely exercising his acknowledged right to appropriate the water, and at least insofar as his action is not motivated by malice, it appears lawful.

Many of the statutory provisions discussed under surface water also apply to ground water.

8. COASTAL WATERS

Much of the law relating to coastal waters has already been examined in dealing with tidal waters under "Rivers, Streams and Lakes". The major public rights, navigation, and shipping, for example, have already been examined. There are, however, minor public rights such as the right to take seaweed floating on the sea and, possibly, the right to bathe in the sea. Neither of these, however, includes rights on the shore. Similarly, the owner of land bounding on the sea has many of the same rights as a riparian owner on a river. Among these are the rights of access, accretion and drainage as well as the right to build bulwarks against the encroachments of the sea. As in the case of rivers, too, a person may make himself liable for a nuisance for polluting the waters of the sea.

As already seen in dealing with tidal rivers, the *prima facie* rule is that a grant of land bounding the sea carried title down to high water mark. Unless expressly granted, the shore, i.e., the land between high and low water mark, remains in the Crown. This means the Crown in right of the province, except where the land has been expressly conveyed to the Crown in right of Canada, as in the case of public harbours.

The ownership of the seabed, however, poses difficult problems. To understand the issues it is necessary to distinguish between two categories of offshore waters, inland waters and territorial waters. Inland waters are waters so intimately associated with the territory of a state that, under international law, they are considered as much the territory of a state as dry land. The common law spoke of waters *intra fauces terrae*, but this seems to amount to the same thing. Territorial waters consist of a belt of water stretching seaward from low water mark or the outer edge of inland waters for a distance, so far as Canada is concerned, of three marine miles for most purposes, though the Territorial Sea and Fishing Zones Act provides for a fishing zone of twelve miles.

The inland waters off the Atlantic Provinces are extensive, and have been from pre-Confederation days. At Confederation they included, under general customary international law, all bays and straits, or parts thereof, capable of being enclosed by lines of six marine miles from shore to shore. Moreover, historic claims could be made that all bays in these provinces, including in particular the large bays, Chaleurs, Conception, Fundy and Miramichi, were inland bays.

Under English law, inland waters appear to be considered as forming part of the adjoining county. This may well be the law in the Atlantic Provinces, for the common law applies there subject to the situation and conditions. Support for this view may be found in the fact that some of the provinces are defined as including certain inland waters. The boundary between Nova Scotia and New Brunswick is drawn across the middle

of the Bay of Fundy, and the Quebec-New Brunswick boundary runs in the middle of the Baie des Chaleurs. It is clear, of course, that waters expressly falling within the boundaries of a province continued to belong to that province at Union. But apart from the Bay of Fundy and the Baie des Chaleurs, there is no provision in the boundaries of the Atlantic Provinces expressly including other inland waters. There are, however, some general terms in the proclamations establishing the Maritime Provinces that may be construed as including inland waters.

Further support for the view that all adjacent inland bays form part of the Atlantic Provinces may be found in the fact that the provinces before Confederation frequently acted on this assumption.

There is, however, support for another theory: that the colonies were entitled to jurisdiction over inland waters only to the extent that such waters had been delegated to them by the British Crown. Even under this theory the Baie des Chaleurs and the Bay of Fundy belong to the adjacent provinces. So does Conception Bay because Newfoundland was recognized by British statutes as having jurisdiction over that bay. The same would be true of any bay so recognized. In fact there is authority that it is sufficient that the colony exercised legislative jurisdiction over adjacent areas even without express delegation. Finally it should be added that the public harbours existing at Union were transferred to the federal government.

Turning to territorial waters, the Supreme Court of Canada in Re: Offshore Mineral Rights of British Columbia held that jurisdiction and ownership of the subsoil of the territorial sea off that province belonged to the Federal Government. It did note, however, that an historical case for a contrary view might be made in other provinces. Such a case might be made for all or some of the Atlantic Provinces, all of which exercised a measure of legislative control over their territorial seas before Confederation. Moreover, there is considerable judicial authority capable of supporting such a holding. In the absence of such an historical case being upheld, however, the reasoning of the British Columbia reference would apply.

WATER RESOURCES
of the
ATLANTIC PROVINCES

PART FOUR

ADMINISTRATION

PART FOUR - ADMINISTRATION

This administrative study is based on the assumption that water can be collectively managed for the benefit of all citizens in the Region.

Consequently there arises the need to develop a management system which has applicability to over-all water resource development, use and control. A model has been developed to serve this purpose. Its essential feature is its focus on decision-making processes, broadly described as policy formulation, policy execution, and policy evaluation. It is cast in the mold of the cabinet system of government, and incorporates elements of the political process, since most of the decision-making in cabinet government occurs at the political level.

To apply the model to water management requires an examination of the nature of water supplies and their relationship to other resources in nature. It also requires an understanding of the wide variety of demands on water, controls over water and conflicts and complementarity of uses, for these have implications for development of an effective management system. Indeed, an analysis by area of use and control would suggest that a wide variety of government agencies are involved, whose activities must be co-ordinated.

Because the system is a governmental one it is necessary to clarify the role of government in water resource development and use. Consequently an economic analysis portraying the function of government for management of water has been presented which indicates that government responsibilities should extend to many areas of use.

The constitution of our federally-structured nation divides government responsibility over water between the federal government and provincial governments. This division of powers requires extensive co-ordinating mechanisms if water resource management systems are to operate effectively.

The findings of this administrative, economic and legal study are contained in the conclusions which follow.

1. FEDERAL AND PROVINCIAL RESPONSIBILITIES

Central Agency Responsibilities

Each level of government should ensure that an agency be designated as the key water resource agency. Such an agency would, within its constitutional jurisdiction, be responsible for:

1) development of over-all water policy;

2) initiation and co-ordination of water resource research and data collection;

3) review and co-ordination of all water legislation and regulation;

4) initial allocation of water among alternative uses, and settlement of disputes. This would entail development of appropriate criteria for efficient allocation of the resource;

5) initial review and co-ordination of all water programs and budgets, including management of multipurpose projects where this appears feasible;

6) development of appropriate methods for measuring program effectiveness;

7) development of appropriate communication facilities for co-ordinating program planning, execution, and evaluation. This would include public information programs.

Resource Use Co-ordination

Each level of government should ensure that water policies and programs are developed and implemented with due regard for other policies concerning resources with which water is closely allied in nature - forest, land, fish and wildlife.

Cabinet Responsibility

Each level of government should ensure that cabinet has final responsibility (subject to parliamentary and legislative approval) over water resource development, use and control. This implies that ministerial direction over the central agency responsibilities listed above is necessary.

Public-Private Sector Co-ordination

Each level of government should consider formal methods of co-ordinating the water-oriented activities of the public and private sectors:

1) to minimize conflicts in use;

2) to achieve optimum use of the resource in given areas and projects;

3) to provide channels of communication on water policies programs and problems between private-sector interests and responsible public agencies.

Provincial-Municipal Co-ordination

Provincial governments should develop an integrated program of water use and control, involving municipal governments in water supply, waste disposal and waste treatment policies, including long-range capital budgeting. Where watershed or river-basin boards appear feasible, municipalities in the area should be active participants.

Federal-Provincial-Municipal Co-ordination

The federal and provincial governments, under the leadership of their respective central water resource agencies, should develop:

1) an Atlantic Regional Committee to review and co-ordinate federal, provincial and municipal programs and budgets for water use;

2) federal-provincial committees to co-ordinate overall management of the resources and management of specific areas of use and control, e.g., fisheries, pollution control.

2. PRESENT MANAGEMENT SYSTEMS - BY AREA OF USE AND CONTROL

The following summary is by area of water use and control. It is presented in this manner to indicate the nature and degree of federal and provincial involvement in water resource management. Agency designations and functions referred to are those in effect in 1968.

Water Supply and Waste Disposal

New Brunswick

Water supply and waste disposal facilities are primarily developed on the initiative of communities, individuals, industries and, in some cases, for industries by provincial and federal government agencies.

Communities may provide residents with water supply and waste disposal facilities provided they are able to obtain the approval of the Municipal Capital Borrowing Board. They must comply with regulations of the Water Authority which ensure that the systems are well-designed, are no pollution hazard, and are not detrimental to environmental health. User charges must be set to cover operating and capital costs; every system must be self-liquidating. Financial assistance on sewage collection is provided by the Water Authority, and on pre-engineering studies for water and sewer systems by the Community Improvement Corporation.

Individual systems may be set up at the discretion of the land-owner, and the Department of Health and Welfare may assist in well and septic tank location when these are installed, and may assist by sampling and testing drinking water.

Industrial water systems are established by industry, subject to requirements laid down by the Water Authority. The Water Authority reviews all plans and designs to ensure that pollution hazards are detected and corrected. Some systems are financed by the federal government (fish-plant water supply) and subsequently turned over to the province for operation. Others are constructed by the New Brunswick Development Corporation for industries located in industrial parks. In both of these cases, and in the case of an industry connected to a municipal system, the industry pays a user charge.

The Water Authority is responsible for allocating all water for water supply and sewage purposes where conflicts are likely to arise.

Newfoundland

The initiative for development rests with the community, individual and industry, although the Department of Municipal Affairs may encourage communities to develop systems (through their system of grants) and the Department of Health may, by its enforcement of preventive health measures, require installation of better water supply and waste disposal systems. The Department of Public Works develops systems for cottage hospitals and vocational schools where municipal systems are non-existent.

Development of facilities is usually the responsibility of the community, individual or industry. The Department of Municipal Affairs may provide engineering services to the community; the Department of Health will test water quality on request. The federal Department of Public Works constructs water supply systems for fish plants; these systems are subsequently owned and operated by the province.

Extensive financial assistance in the form of loans and grants is provided to communities for development and operation of water supply and sewer facilities. The intent is to reduce the burden on communities and to provide some measure of equalization among communities in financing these systems. All water rates and bond financing are approved by the local government division of the Department of Municipal Affairs, except for provincially-owned utilities, where the Water Authority sets the rate.

Before construction commences, all designs must be approved by the Water Authority, Department of Health, and Department of Municipal Affairs. Where additional Crown land is required, or construction on Crown land is contemplated, the Department of Mines, Agriculture and Resources approves leases. Where alteration of surface water is required, Water Authority approval must be obtained.

Nova Scotia

Water supply facilities are developed by industries, individuals and communities.

The Department of Trade and Industry (Industrial Loan Board) and Finance and Economics (Industrial Estates Limited) provide financial assistance to industries, including water supply facilities, though loans and grants are not made specifically for this purpose. Industries do not pay for water used, unless they are connected to a public water utility.

Community water supply systems are developed locally; financial assistance is available from the Department of Municipal Affairs and the Department of Agriculture and Marketing.

Individual farm systems are developed by farmers, but often with the aid of the Department of Agriculture and Marketing in building farm ponds for stock watering and fire protection purposes.

The provincial government also owns and operates water utilities. The Nova Scotia Water Resources Commission operates water utilities constructed by the Atlantic Development Board.

Water systems are subject to a wide range of regulation. The most significant are those exercised by the Department of Public Health, Division of Environmental Hygiene, which approves all designs for community and industrial water supply systems. Individual systems may be studied and water quality tested on request. The Nova Scotia Water Resources Commission exercises broad powers. It approves jointly with the Department of Public Health the design of water systems for communities and industries, including large farm-water-supply systems; it may also regulate the quantity of water allocated for specific water supply uses in the province.

The Board of Commissioners of Public Utilities approves all public water utility rate structures but may except those operated by the Nova Scotia Water Resources Commission.

Other forms of provincial regulation include control over levels of capital borrowing for water supply systems, lot sizes (in relation to the type of water supply system), and the quality of water supply systems of motels, hotels and other tourist facilities.

Prince Edward Island

Development of water supply and waste disposal facilities is initiated primarily by individuals, communities and industries. The Department of Municipal Affairs may persuade communities to develop facilities by helping to pay for consulting services prior to the development stage.

The responsibility for research, development and design is that of the individual, community, or industry, except where the Atlantic Development Board finances the construction of water supply facilities for fish plants, which may also serve adjacent communities.

The Public Utilities Commission regulates water user rates for municipalities, and for industries when these are connected to municipal systems. Industries with their own supply systems are unregulated. Rates for provincially-owned water utilities are regulated by the Water Authority.

Where stream alterations are required to install a system, approval of the Water Authority's Stream Alterations Committee is required. Where a well must be drilled, approval of

the Authority is required. Lot size regulation, depending on the nature of water and sewer facilities installed, is the responsibility of the Provincial Board. Where a provincial guarantee is involved, bond issues for both water and sewer facilities are approved by the Department of Municipal Affairs.

The Department of Fisheries may issue permits to remove sea birds and other forms of wildlife from sewage lagoons.

The Water Authority provides financial assistance to communities for development of designs for water and sewer facilities. Sewage treatment grants are also provided as an incentive to communities to install treatment facilities. The Department of Fisheries pays up to 100 per cent of well drilling costs for fishermen needing water for fish-cleaning and processing purposes.

Government of Canada

Direct federal government involvement in water supply systems is minimal, though considerable financial assistance is provided. Federal departments such as Transport, Defence, and Indian Affairs and Northern Development develop, construct, maintain and operate facilities on federal property including the setting of rates for commercial and other users.

The Rural Development Branch of the Department of Forestry and Rural Development undertakes surveys and feasibility studies for rural water supply systems on request by the provinces.

The Department of National Health and Welfare, Health Services Branch, Public Health Engineering Division, regulates the public health aspects of water quality on federal projects.

The Atlantic Development Board finances 100 per cent of approved industrial water supply systems which the Department of Public Works constructs. The provinces are responsible for ownership and operation of such systems.

The Water Quality Division and the Water Survey of Canada and Hydrological Sciences Division of the Department of Energy, Mines and Resources, and the Meteorological Branch of the Department of Transport provide assistance to federal, provincial and municipal agencies and industries concerning water quantity and quality in specific areas of the region.

Federal government agencies are responsible for construction, operation and maintenance of waste disposal and waste treatment facilities on federal property. Commercial users of these facilities, e.g., restaurants in National Parks, may pay user charges. The Public Health Engineering Division regulates pollution control facilities on federal property. Financial

assistance to industries for pollution abatement has been provided by the Atlantic Development Board. The Central Mortgage and Housing Corporation provides sewage treatment loans to municipalities. The Department of Fisheries regulates pollution on streams, rivers and coastal areas in order to protect and conserve the region's fisheries resource.

The Water Quality Division of the Inland Waters Branch is involved in water pollution abatement investigations concerning the base metal mining operations in New Brunswick.

Recreation
(including fish and wildlife conservation)

New Brunswick

Individuals use the province's water resources and associated resources (fish, waterfowl and beaches) for recreational purposes. Subject to fish and game regulations, individuals may use these resources as they desire. There are private fishing preserves, some of which are opened to the public for a fee, as well as public fishing preserves.

The Fish and Wildlife Branch of the Department of Natural Resources is responsible for designating game management areas and refuges so that species are protected and effectively managed. The Parks Branch is responsible for planning, developing, operating and maintaining provincial parks, including water-oriented facilities such as beaches, swimming areas and marinas for public use. Water supply, waste disposal and treatment facilities are provided by the department subject to regulations of the Water Authority. Any alteration of streams for fish and wildlife purposes or parks must receive the approval of the Stream Alterations Committee of the Water Authority. Both of these branches develop their own programs and recommend these to the Deputy Minister and Minister of Natural Resources, and subsequently to the Treasury Board for approval. Co-ordination of program planning takes place in the department prior to budget submission.

Newfoundland

The Divisions of Wildlife and Parks in the Department of Mines, Agriculture and Resources are the agencies primarily concerned with recreational programs with a water content. The initiative for recreational developments comes from both of these agencies, the Division of Parks being responsible for development of shorelines, beaches and marinas for recreational purposes. The Wildlife Division designates wilderness areas, bird sanctuaries, game sanctuaries and game reserves for the protection of wildlife, including waterfowl and fur-bearing animals, and in doing so promotes recreational enjoyment of water-oriented wildlife for residents and tourists.

Use of Crown lands for the above purposes, including building of cottages on lakes and beaches, requires approval of the Crown Lands and Surveys Division of the same department, while alteration of any water body requires approval of the Water Authority. Water and sewage facilities constructed in parks must be approved by the Water Authority and the Department of Health. The Department of Health also regulates water quality in provincial parks as part of their program of testing all public water supplies.

The Division of Parks regulates pollution within the boundaries of park areas, and the Forest Service of the Department of Mines, Agriculture and Resources enforces game regulations throughout the province.

Nova Scotia

The Department of Lands and Forests, Wildlife Conservation Division and Parks Division, is responsible for water-related recreational activity in Nova Scotia. The Conservation Division licenses fishermen, enforces wildlife regulations, and in co-operation with the Canadian Wildlife Service, National Parks Service, and Canada Department of Fisheries, promotes effective management of fish and wildlife in the province. The Division works closely with the Department of Agriculture and Marketing, ARDA Division, in making effective use of marshlands and wetlands and in developing an inventory of recreation land.

The Parks Division plans, develops and operates provincial parks; has undertaken the classification of beaches and provided water supply facilities for users; and controls the removal of sand and gravel from recreational areas (below high tide).

Financial assistance is provided for fish and wildlife conservation through the ARDA program, when projects are suitable for this purpose.

Prince Edward Island

At the provincial level fish and wildlife conservation is the responsibility of the Fish and Wildlife Division of the Department of Fisheries. This division is responsible for development of wetlands and fishing ponds in the province for recreational use as well as for preservation of fish and wildlife species. All licensing and regulation is administered and enforced by the division except for national parks. The Water Authority approves all stream alterations required for fish and wildlife conservation and recreation purposes.

Provincial parks are developed by the Parks Division of the Department of Tourist Development, although the Economic Improvement Corporation is currently developing an expanded rec-

reational program for the province. Municipalities may also develop recreational facilities locally, seeking advice and assistance from the Parks Division.

Regulation of swimming and boating within provincial parks is the responsibility of the Parks Division, while the Fish and Wildlife Division licenses boats used for recreational purposes.

There are currently no programs of financial assistance to the private sector for recreational purposes, although such projects could be incorporated as part of a loan from the Tourist Loan Board.

Government of Canada

Federal involvement in water-related recreation is mainly the concern of the Department of Fisheries, the Canadian Wildlife Service and the National Parks Service of the Department of Northern Affairs and Indian Development, the Canals Division of the Department of Transport, and the Department of Public Works.

The Department of Fisheries is responsible for the protection, management and development of all fisheries in Canada where responsibility has not been delegated to the provinces, which is the case in the four Atlantic Provinces.

It works closely with provincial authorities in developing fish regulations including setting catch limits, in the prevention of pollution detrimental to fish conservation, and in regulating the operation of fish-processing plants, including water quality.

The Department of Indian Affairs and Northern Development, Canadian Wildlife Service, is concerned with acquisition of wetlands, management of all migratory waterfowl and wildlife in National Parks, and is responsible for carrying out research on water productivity and on biology of game fish and for advising the National Parks Service on game-fish management.

The National Parks Service of the same department develops, operates and maintains National Parks in the region, and is responsible for management of sport fisheries and for regulating pollution.

The Canals Division of the Department of Transport provides transportation facilities for recreational craft (St. Peter's and Canso Canals) and regulates pollution in canals.

The Department of Public Works assists private developers through its marina policy and tourist wharf programs which enable the department to finance and construct water-based recreational facilities for the general public.

Power

New Brunswick

New power developments in the province fall under the jurisdiction of the New Brunswick Electric Power Commission. The Commission has wide powers of expropriation to develop hydroelectric generating facilities. It should be noted that the Power Commission may develop new facilities without the approval of the Water Authority, although in practice close co-operation is maintained. The cabinet approves all major plans for power development. The most recent project has been at Mactaquac, where a large hydroelectric facility has been constructed. Benefit-cost analysis is used to determine the feasibility of hydroelectric projects compared to thermal plants. Co-ordination occurs with the Department of Natural Resources and the Canada Department of Fisheries in developing headponds for recreational use and in protecting the fisheries resource. Assistance is provided to the Water Authority in controlling stream flow to regulate pollution.

Newfoundland

Hydroelectric power in Newfoundland is generated by private companies and by the Newfoundland and Labrador Power Commission. The initiative for research, planning, and design has been in both the private and public sectors. All future developments are to be in the hands of the Commission. This body has wide latitude in the use of surface water for generating purposes, not requiring Water Authority approval for altering or diverting surface waters. Where Crown land is used, approval of the Crown Lands and Surveys Division is required, but this is a procedural rather than substantive matter.

Nova Scotia

Hydro-power generation in Nova Scotia is being carried out for the most part by the government-owned Nova Scotia Power Commission, and the privately-owned Nova Scotia Light and Power with small hydro-generating operations being owned by the Bridgewater Electric Service Commission and Minas Basin Pulp and Power Company Ltd., and the Town of Berwick. In recent years, the development of all new hydro-power sites has been carried out by the two aforementioned major utilities. Before carrying out a hydro project, the utility must obtain approval of the Water Resources Commission in order to use water or alter a stream for power generation purposes. Following the receipt of this approval, the utility concerned develops the hydro-power sites and constructs, operates and maintains them. A nominal charge is paid by the utility concerned to the Nova Scotia Water Resources Commission for the use of water for generation purposes.

The Atlantic Industrial Research Institute has provided some advice to deal with engineering problems arising out of construction of hydro-power facilities.

Prince Edward Island

There are no hydro-power generating facilities in use on the Island.

Government of Canada

The federal government has limited involvement with hydro-power generation in the Atlantic region. The Atlantic Development Board provides financial assistance for power generation projects, while the Department of Energy, Mines and Resources, Inland Waters Branch, Engineering Division, provides financial and technical assistance in conducting an Atlantic tidal power feasibility study.

The International Joint Commission approves hydro-power generation projects on international rivers and may regulate reservoir levels and flows of water through such works. The Department of Transport and the Department of Fisheries must approve all such projects where they affect the public right of navigation and fishing.

Fisheries

New Brunswick

The only aspect of fisheries at the provincial level which appears to be water-related is the regulation of water supply and waste disposal facilities in fish plants which trade solely within the province. This regulatory activity is performed by federal fisheries personnel acting on behalf of the provincial Department of Fisheries, Fish Inspection and Marketing Branch. These inspections ensure that the quality of water and waste disposal facilities are sufficiently high not to be detrimental to the quality of fish processing.

Where water supply systems are financed and built by the Atlantic Development Board and turned over to the provincial government for operation, the Water Authority sets user charges for supplying water.

Newfoundland

The use of water for commercial fisheries is initiated by fishermen and commercial fish plants. The former are not within the terms of reference of this study. Commercial fish plants obtain water (salt and fresh) to assist in their cleaning and can-

ning operations. Water and waste disposal facilities are developed by fish plants, often with the assistance of the federal Department of Fisheries. Some of the water supply facilities have been financed by the Atlantic Development Board, as part of the program of regional economic development. These are turned over to the province for operation, usually to the provincial Water Authority, which sets rates for water use.

Inspection of fish-plant water supply and waste disposal facilities is undertaken by the federal Department of Fisheries.

Nova Scotia

The province has little to do with the water-related aspect of fisheries.

The Inspection Service of the federal department assists the provincial government by inspecting water supply and waste disposal systems of fish plants which market solely in the province.

Some fisheries research and management is provincially financed (Nova Scotia Research Foundation and Department of Lands and Forests - fish culture and fresh-water research, fish farming) and some falls under provisions of the ARDA Agreement (oyster farming research). The purely commercial aspect of fisheries (aid to fishermen, marketing of the product) is not dealt with in this report.

Prince Edward Island

Water supply facilities for the fishing industry are dealt with under water supply. Inspection of fish plants is undertaken by the federal Department of Fisheries.

Government of Canada

The Department of Fisheries and the Fisheries Research Board are the agencies chiefly concerned with the protection and management of this water-related resource.

The regulation of all works which may affect the public right of fishing is the responsibility of the Department of Fisheries; this is exercised through the Resource Development and Conservation and Protection Services, which also take measures to reduce pollution which may be harmful to fish. The Fisheries Research Board undertakes fundamental and applied research, including anti-pollution research, to assist in developing and expanding the resource available for commercial and recreational use.

Irrigation

New Brunswick

There is a modest level of irrigation in New Brunswick. The provincial and federal governments finance irrigation development through provisions of the ARDA Agreement. The Department of Agriculture provides free engineering services at the design stage, and supervises construction of facilities. Provincial irrigation policy provides for financial assistance for equipment and construction of water supply systems for irrigation purposes. Where a stream requires alteration, Water Authority permission is required before development may take place.

Newfoundland

Only one commercial irrigation system in Newfoundland was brought to the attention of the consultant. This is a system for vegetable production, using water from the Terra Nova. The initiative for development of such systems, and the responsibility for operation and maintenance is clearly in the hands of the industry. But future alteration of streams for water supply purposes would require Water Authority approval. No financial assistance is currently provided for irrigation in the province.

Nova Scotia

Some irrigation activity occurs in Nova Scotia. Provincial involvement includes financial and technical assistance by the Department of Agriculture and Marketing, ARDA Division. The Extension and Economics Branch of the same department provides financial assistance to farmers who wish to build farm ponds for irrigation purposes.

The Nova Scotia Water Resources Commission must approve any stream alteration required to assist in the provision of irrigation works.

The Extension and Economics Branch of the Department of Agriculture and Marketing will be responsible for constructing, operating and maintaining irrigation works on the Musquodoboit River, as part of the over-all development of the watershed.

Prince Edward Island

Irrigational use of water on the Island is limited to small commercial enterprises. They are treated in the same manner as industries. Initiative, development of works and administration is the responsibility of the industry. No programs of financial assistance for water supply or waste disposal are available. Major stream alterations would require the approval of the Water Authority, but no cases have yet arisen.

Government of Canada

The federal government is involved in irrigation projects in the Atlantic Region through the Department of Forestry and Rural Development. Many studies have been completed; however very few projects have commenced to date, and for convenience, are dealt with under soil and water conservation below.

Water Commerce - Transportation and Log Driving

New Brunswick

Transportation for commercial purposes on inland waters of the province, except in coastal areas, is virtually non-existent. There is no public transport except for interprovincial facilities. Private companies operate ferry services between New Brunswick and Nova Scotia, and between the mainland and Grand Manaan Island, but the latter is not inland water commerce.

Were water transport again to become prominent, Water Authority approval, in addition to federal government approval, would be required for stream alterations, including wharves, landings, and dredging of channels.

Log driving, though declining, still occurs in the province. Log-driving companies require permits from the Water Authority to effect stream alterations, and require approval from the Department of Natural Resources, Forest Branch, for landing-sites. The Water Authority may also require restriction of log driving to reduce pollution.

Newfoundland

Water commerce (navigation) is regulated only by the federal government. Use of inland water for transportation is negligible, but coastal waters are extensively utilized for this purpose. The Water Authority has not become involved in approval of wharves, landings, dredging for such purposes in coastal areas.

Log drivers have extensive rights and are excluded from regulation by the Water Authority, although major pollution problems and stream alterations would conceivably come under the surveillance and control of the Authority. Use of Crown lands for log driving requires a lease from the Department of Mines, Agriculture and Resources, Crown Lands and Surveys Division, which regulates all use of Crown land for any purpose, including water-related activities.

Nova Scotia

The provincial Department of Public Works occasionally constructs wharves to assist in public navigation. Where streams are used for log driving, the approval of the Nova Scotia Water

Resources Commission must be obtained, except where separate legislative provision has been made permitting particular companies to use streams for this purpose.

Prince Edward Island

Use of inland waters for transportation or log driving is non-existent.

Government of Canada

The National Harbours Board is responsible for development, operation and maintenance of National Harbours in the region. The Department of Transport, Canals Division, operates and maintains canals in the region and the Marine Works Branch is responsible for the operation and maintenance of public wharves (except those under the National Harbours Board). The Department of Public Works undertakes the construction of many federal marine works including wharves, navigation channels, shore protection works, and dams.

Any works constructed on navigable rivers require Department of Transport approval, and on boundary waters, International Joint Commission approval. Where these affect the fisheries resource, Department of Fisheries approval is required.

The Department of Energy, Mines and Resources, Marine Sciences Branch, provides assistance in wave-motion and related studies which may affect construction of federal navigation works.

Pollution Control

New Brunswick

The New Brunswick Water Authority is the key agency in the provincial government responsible for the prevention and control of water pollution. The Department of Health and Welfare prevents and controls environmental health hazards associated with water pollution, and works closely with the Water Authority in the exercise of its duties.

The Authority jointly with the Department of Health and Welfare approves all community and industrial water supply, waste disposal and treatment facilities; it assists communities and industries in developing and operating waste treatment works. It maintains a watch on pollution levels in streams, rivers and lakes (in co-operation with federal authorities), and is empowered to take regulatory action when pollution levels become too high. Through its Stream Alterations Committee it approves all works affecting stream flows, assessing the impact of such changes on fish conservation (with the assistance of federal and provincial fishery authorities).

The Authority administers grants to municipalities and industries for the construction of pollution control facilities; it assists in financing research conducted by the federal government to determine existing pollution levels on major fishing rivers in the province and how best to reduce them.

Newfoundland

There are several agencies in the provincial government concerned with pollution control. The Water Authority and the Department of Health are the key agencies, the latter being concerned with the control of environmental health hazards originating in water supply and waste disposal facilities. At present the two agencies approve all community and industrial water supplies, waste disposal and treatment facilities before construction proceeds. The Authority utilizes engineering consultants for this task, having no permanent staff for pollution control activities.

A number of other agencies are involved in pollution control. The Division of Parks regulates pollution in parks. The Crown Lands and Surveys Division regulates pollution of streams by pulp, paper and sawmills. The Local Government Division may regulate pollution in sources of municipal water supplies. No financial assistance is provided to industry for pollution control purposes. Municipalities receive extensive grants for water, waste disposal and waste treatment facilities.

Nova Scotia

A number of agencies are concerned with pollution control in Nova Scotia:

1) Department of Public Health - Division of Environmental Hygiene - regulation of community and industrial water supply, waste disposal and waste treatment systems; regular sampling of public water supplies; testing individual water supply systems on request; advising on location of wells and septic tanks.

2) Nova Scotia Water Resources Commission - jointly with the Division of Environmental Hygiene, approves industrial and community water supply, waste disposal, and waste treatment systems; provides financial assistance for community waste treatment systems; prescribes public water supply areas for purposes of pollution control.

3) Board of Commissioners of Public Utilities - may order communities to improve pollution control facilities.

4) Department of Lands and Forests - prevents sawmill operators from dumping sawdust into streams.

5) The Atlantic Industrial Research Institute - has provided advice and assistance on the construction, operation and maintenance of industrial and community waste treatment facilities.

6) The Department of Highways - prevents pollution by contractors.

Prince Edward Island

Several agencies are involved in pollution control. The primary agency is the Prince Edward Island Water Authority which finances pollution control research, assists municipalities in installing waste treatment facilities, regulates pollution in municipalities and industries, and approves the use of streams for disposal of wastes. The Economic Improvement Corporation has financed pollution control studies; the Parks Division regulates pollution in provincial parks; the Fish and Wildlife Division issues permits for removal of seabirds and wildlife from sewage lagoons.

Government of Canada

The federal government has extensive responsibilities for pollution control. These have been discussed under the areas of use above, and may be summarized briefly:

1) Department of National Health and Welfare, Public Health Engineering Division - control and abatement of water pollution resulting from the operation of all federal government facilities; water quality measurement for other federal agencies.

2) National Parks Service - regulation of pollution in National Parks.

3) Department of Fisheries - regulation of pollution affecting the fisheries resource.

4) Fisheries Research Board - anti-pollution research.

5) National Harbours Board - regulation of pollution in harbours.

6) Steamship Inspection Service - regulation of oil pollution by ships in Canadian waters.

7) Canals Division - regulation of pollution in canals.

8) Canadian Wildlife Service - monitoring of pollution in coastal and inland waters to protect the wildfowl resource.

9) International Joint Commission - investigation and advice respecting pollution problems on international rivers.

Soil and Water Conservation

New Brunswick

Soil and water conservation projects are primarily in the areas of reclamation and drainage and water conservation. The Department of Agriculture, Agricultural Engineering Branch, is the key provincial agency in this field. It provides free engineering services and finances tile underdrainage and main outlet drainage projects, with the assistance of the federal government through the ARDA program. The Branch has also undertaken the construction of farm ponds to provide farmers with water supply for stockwatering purposes.

The Director of the Branch is also the Chairman of the Marshland Reclamation Commission, a body of government officials and farmers responsible for directing the work of local Marsh Bodies which operate and maintain dykes and aboiteaux on marshlands in the province. Financial assistance is provided through the ARDA Agreement.

Where a stream or body of water requires alteration for land reclamation purposes, Water Authority approval is required.

Newfoundland

The chief activity is bogland reclamation and drainage undertaken by the Department of Mines, Agriculture and Resources, Division of Agriculture. The Department may initiate the work, although much of it has occurred due to federal participation through the ARDA program. The Division secures leases through the Crown Lands and Surveys Division and undertakes the required research, planning and design of works with the assistance of the Crown Lands and Surveys Division in surveying, and the construction of works necessary to effective drainage of the land. Extensive financial assistance is provided under the provisions of the ARDA Agreement.

Nova Scotia

The agricultural use and control of water is managed primarily by the Department of Agriculture and Marketing, ARDA Division. Financial and technical assistance is provided on a wide variety of projects including erosion control, tile drainage, rural ponds and wetland drainage. The Musquodoboit Valley Reclamation Board and the Department of Agriculture and Marketing,

Extension and Economics Branch, are jointly involved in the construction, operation and maintenance of works which are being used to reclaim land for agricultural purposes.

It may be noted that the Farm Loan Board provides financial assistance to farmers for reclamation and drainage projects.

Any major stream alterations required to conserve water (rural ponds) or to protect land (erosion control works) require the approval of the Nova Scotia Water Resources Commission before work may proceed.

Prince Edward Island

The primary responsibility for initiating soil and water conservation projects on the Island rests with farmers and communities. Both are primarily concerned with water storage; these usually involve construction of dams. Contractors are retained by the individual or municipality, but supervision is usually under the direction of the ARDA Co-ordinator of the Department of Agriculture except for large projects, when the field offices of the federal Department of Forestry and Rural Development may be used to assist in supervision. Financial assistance to farmers is available under provisions of the ARDA Agreement.

All stream alterations must be approved by the Water Authority, which in turn obtains advice from the provincial Department of Fisheries to determine the effects of dam construction on fish and wildlife in the area.

Government of Canada

Irrigation and reclamation and drainage projects are usually initiated by farmers, communities or provincial governments. Federal financial assistance is provided under the ARDA Agreement, and under FRED Agreements. Technical assistance is provided through the Department of Forestry and Rural Development, Rural Development Branch. The Atlantic Development Board also provides financial assistance to assist in covering the cost of equipment for draining and reclaiming boglands.

Projects falling under this category include bogland and marshland drainage and reclamation; development of rural ponds for stockwatering, irrigation, and fire protection; and dam construction.

Flood Control

New Brunswick

No flood control projects (apart from reclamation and drainage) exist in New Brunswick. Whenever flood danger arises, usually on the Saint John River, the Water Authority, New Brunswick Electric Power Commission, the Civil Engineering Department of the University of New Brunswick and the federal representative from the Department of Transport, Meteorological Branch, co-ordinate efforts to provide a flood forecasting system, and to guide *ad hoc* flood control measures.

Newfoundland

The Department of Mines, Agriculture and Resources, Division of Agriculture, has developed a small flood control program on the west coast. Approval of the Water Authority is required when altering a stream for flood control purposes. Where such a scheme is constructed on Crown lands, approval of the Crown Lands and Surveys Division is required.

Nova Scotia

The major flood control activity in the province is flood control on the Musquodoboit River. The Musquodoboit Valley Reclamation Board has been set up specifically to achieve this purpose, and to increase the utility of both agricultural and water resources along the valley.

Two agencies of the provincial government are particularly concerned with the provision of financial and technical assistance for the project. These are the ARDA Division and the Extension and Economics Branch of the Department of Agriculture and Marketing. Works which require alteration of the water course must be approved by the Nova Scotia Water Resources Commission before construction may proceed.

Prince Edward Island

There are no flood control projects on the Island.

Government of Canada

The Department of Forestry and Rural Development, Rural Development Branch, is the prime federal agency concerned with flood control in the region. Projects in the Atlantic region are quite limited, with the exception of the Musquodoboit Valley in Nova Scotia. Such projects involve federal financial and technical assistance under the terms of the ARDA Agreement.

Watershed Management

New Brunswick

Nil.

Newfoundland

There are no all-inclusive watershed management programs in the Province of Newfoundland. However, the Planning Division of the Department of Municipal Affairs is empowered to regulate watersheds within the context of a land-use program, where protection of the water resource may be desirable to meet future needs. The Department of Health is empowered to approve the use of all water from a watershed.

Nova Scotia

Nil.

Prince Edward Island

Some watershed basin planning is underway on the Island. Data on watersheds are being gathered by several federal and provincial agencies. The Fish and Wildlife Division has prepared a major development plan for fish and wildlife conservation on a watershed basis. The Economic Improvement Corporation has undertaken to collect data on two watersheds. Stream gauging by the Inland Waters Branch of the federal Department of Energy, Mines and Resources is financially assisted by the Prince Edward Island Water Authority.

There are currently no operative management programs for water resources or water-related resources being administered on a watershed basis.

Government of Canada

Nil.

Basic Research and Data Collection

New Brunswick

The Water Authority undertakes some basic research and data collection for pollution control purposes, and assists in financing data collection by the federal government agencies. The New Brunswick Electric Power Commission conducts stream gauging for hydroelectric power generation purposes.

Newfoundland

Nil.

Nova Scotia

The Department of Mines, Groundwater Section, in co-operation with federal authorities, investigates characteristics of the ground-water resource in the province. Observation wells have been drilled for hydrological studies.

The Nova Scotia Research Foundation and the Atlantic Industrial Research Institute finance and undertake research and data collection. The Atlantic Industrial Research Institute has undertaken research in water quality to aid in improving domestic and community pollution control facilities, and in ocean engineering, to develop more effective wave-measuring devices.

The Research Foundation has undertaken waste-treatment research on a confidential project, and has done a study of effluents emitted by herring reduction plants and a brewery.

Prince Edward Island

Nil.

Government of Canada

Extensive research and data collection are carried out by a number of federal agencies. The agencies and their areas of activities as of 1968, are listed below.

Areas of Activity

1) Ground Water

Department of Energy, Mines and Resources,
Inland Waters Branch
- Hydrologic Sciences Division
- Water Quality Division

2) Hydro-Meteorology

Department of Transport, Meteorological
Branch

3) Surface Water

Department of Energy, Mines and Resources,
Inland Waters Branch, Water Survey of Canada
- Engineering Division
- Water Quality Division

4) <u>Oceanography</u>

Department of Energy, Mines and Resources
- Marine Sciences Branch

Fisheries Research Board of Canada

5) <u>Hydrography</u>

Department of Energy, Mines and Resources
- Marine Sciences Branch

6) <u>Water Resource Research Policy and Special Studies</u>

Department of Energy, Mines and Resources
- Policy and Planning Branch

Atlantic Development Board

Science Secretariat

7) <u>Pollution Control Research</u>

Pollution control research and study is primarily undertaken by: Fisheries Research Board of Canada; Department of Energy, Mines and Resources, Inland Waters Branch, Water Quality Division; Department of National Health and Welfare, Health Services Branch, Public Health Engineering Division; and International Joint Commission.

<u>Co-ordinating Devices</u>

1) <u>Fisheries Research Board</u>

2) <u>National Research Council - International Hydrological Decade</u>

Canadian National Committee

3) <u>National Research Council - Associate Committees</u>

Associate Committee on Water Pollution Research

Associate Committee on Geotechnical Research - including snow and ice mechanics

Associate Committee on Geodesy and Geophysics
- Subcommittee on Hydrology
- Subcommittee on Meteorology and Atmospheric Sciences

4) Canadian Committee on Oceanography

5) Department of Energy, Mines and Resources, Policy and Planning Branch

6) National Advisory Committee on Water Resource Research

7) Atlantic Development Board

Atlantic Provinces Water Resources Supervisory Committee

8) International Joint Commission

(Co-ordinates the activities of agencies concerned with water management by appointing individuals to supervisory boards from appropriate agencies in Canada and the United States.)

3. MANAGEMENT PROBLEMS

Significant problems in the management of water resources in the Atlantic Provinces appear to exist at the present time. It should be stressed that the problems are not (with the exception of the federal government) primarily structural. Rather, they are largely related to the definition of appropriate responsibilities which central water resource agencies are not, for the most part, carrying out effectively at present. The problems also reflect the absence of a cohesive and co-ordinated approach to water resource management, with the consequence that many water problems are not being systematically resolved.

Looking at the Region as a whole, and without attempting to pinpoint specific problems relating to any single province, three general classes of management problems may be identified. They relate to policy formulation, policy execution and policy evaluation.

Policy Formulation

Planning

Effectively co-ordinated policy and program planning for water resources at the federal and provincial levels appears to be lacking. Each water agency is responsible for development and implementation of its own aspect of water policy, but these separate policies are not adequately integrated.

The Policy and Planning Branch of the federal Department of Energy, Mines and Resources is currently initiating and co-ordinating efforts to develop a national water policy. An interim interdepartmental committee on water policy is responsible for co-ordinating federal water resource policy, but has not yet begun intensively to examine and co-ordinate programs for the Atlantic Provinces. There is recognition of the problem at the federal level, but effective co-ordinating machinery does not appear to exist except on an ad hoc basis.

Though there are central water authorities in the provinces with wide powers over management of water resources, the absence of an integrated water policy is noticeable. By and large, provincial agencies currently devote their efforts to development and implementation of water or water-related programs without preliminary review and co-ordination of policies at the water authority level. The composition of the authorities in general suggests a concern for public-private sector co-ordination with emphasis on pollution control, but interdepartmental policy co-ordination is not formalized to any great extent.

Federal-provincial liaison and co-ordination in policy and program planning is not extensive despite the need, suggested in this report, for close ties in several areas of use and control. The structures to facilitiate such co-ordination do not exist at present.

Further, one can note - especially at the provincial level - inadequate co-ordination of water policies with economic development plans. Though the need may not be considered by some to be great, the absence of such integration could lead to misjudging or misplacing water program emphases within the over-all context of economic policy.

Data Collection and Research

Most of the data collection and research in the Region is carried out by federal agencies, though several provincial agencies have responsibilities in this field. Several co-ordinating bodies for specific areas of research exist at the federal level, while none exist at the provincial level. Nor are there any formal federal-provincial or regional structures with responsibility for co-ordination of data collection and research activities.

The National Advisory Committee on Water Research studies and recommends priorities for water research in Canada. However, there is no one agency responsible for bringing together and integrating the data collection and research activities of all federal agencies as they relate to the Region. Both the high level of federal expenditure on data collection and research and the variety of its programs suggest the need for effective co-ordination. It would also be useful to co-ordinate planning for research and data collection with other related program plans at the federal level - for example, anti-pollution research and pollution control programs.

Federal-provincial co-ordination at the planning level for data collection and research is limited to specific projects where special provision is made (for example, I.H.D. projects) but no over-all research planning mechanisms are apparent.

Legislative Planning

There is currently no effective machinery for continuous review and integration of legislation affecting water resources policies and management, at both federal and provincial levels. The federal government is engaged in developing new legislation for a national water policy, but has not developed the means to ensure that all legislation affecting water use is centrally reviewed and co-ordinated. There is no sign at the provincial level of any co-ordination and approval of water-related legislation before submission to the cabinet and legislature, except on an *ad hoc* referral basis.

Budgeting

The extent to which budgets, reflecting program plans, are integrated is a good indication of the extent of policy and program co-ordination. Unfortunately, it appears that very little co-ordination at the budgeting level occurs. Interdepartmental co-ordination of budgets of water-related programs at both federal and provincial levels remains a goal yet to be achieved. This is a major problem. The consequence is a lack of thoughtful program and policy integration, requiring in its place extensive informal arrangements to co-ordinate policy or to co-ordinate program implementation in the field.

Federal-provincial or regional water resource budget co-ordination does not occur. Further, there is an absence of effective co-ordination of water-related budgets with budgets which are oriented to regional economic development; this means that water policies and programs cannot be considered a fully integral element of economic policy.

Policy Execution

This study was not focused on policy execution. However, it is apparent that both federal and provincial officials rely heavily on informal co-ordination to fill the gaps left by lack of effective co-ordination at the policy and program planning and budgeting stages. Measures to ensure effective co-ordination at pre-implementation stages would help to overcome this difficulty.

Policy Evaluation

Program Control

Were an integrated program for management of water resources developed, it would be possible to formulate effective methods of program control. This means developing appropriate criteria for measuring the effectiveness of various water programs in terms of an over-all water policy for the Region. There is currently an absence of explicit criteria at both federal and provincial levels for many specific programs.

The question of developing appropriate explicit criteria for measuring program effectiveness is by far one of the most crucial issues facing use of the resource. In their absence, implicit political-social-economic criteria may be used which may be so general as to be virtually meaningless, leaving many decisions concerning budgets open to short-run influences and persuasion which may be detrimental to the generation of effective long-range water use programs.

Dispute Settling

The settlement of disputes among public agencies (questions of policy and program) are resolved through the mechanisms of cabinet government. Public-private sector disputes have more and more been referred to water authorities rather than the courts, although this method of resolving differences is in its infancy.

As water policy is better defined and becomes in part an arm of social and economic policy, it seems reasonable to assume that more decisions affecting allocation will be taken by governments. Given this prospect, it is clear that present legislative provisions do not provide adequate relief. There is currently no consideration given in provincial legislation to public hearings and systems of appeal from allocative decisions affecting persons with interests in water resource use. Provision of effective machinery implies the selection of appropriate criteria for allocation purposes and the use of such criteria in decisions affecting public and private interests.

Communication

There is limited formal communication for policy formulation and evaluation at both federal and provincial levels. Too much reliance is placed on informal and *ad hoc* devices. In addition, there appears to be an absence of effective public information programs at the provincial level designed to systematically inform the community about water policy objectives and programs.

TABLE 4-1

Summary of Estimated Professional and Technical Personnel Devoted to Water Resource Management, By Area of Use and Control

Purpose	Man Years - 1967-68					
	N.B.	Nfld.	N.S.	P.E.I.	Gov't of Canada	Total.
A. Consumptive and Non-Consumptive Use						
1. Water Supply and Waste Disposal	-	2.25	9.1	3	2.5*	16.85
2. Recreation						
Fish and Wildlife Conservation	11	-	3	2.6	16	32.6
Other	-	-	-	-	5	5
3. Power	9	1.15	11.25	-	2.6	24
4. Fisheries	-	-	-	-	178	178
5. Water Commerce (including Transportation and Log Driving)	-	-	-	-	51.6	51.6
6. Irrigation	2	-	-	-	See B(2)	2
Sub-total	22	3.40	23.35	5.6	255.7	310.05
B. Control						
1. Pollution Control	11	10	20	2.5	16.1	59.6
2. Soil and Water Conservation	6	3	3.5	0.5	10	23
3. Flood Control	-	-	-	-	11	11
Sub-total	17	13	23.5	3.0	37.1	93.6
C. Planning, Research and Data Collection						
1. Hydrology						
Groundwater Research	-	-	9.4	-	5.15	14.55
Surface Water Data Collection	2	-	-	-	28	30
Hydrometeorological Research and Data Collection	-	-	-	-	1.75‡	1.75
2. Anti-Pollution Research (includes water quality)	0.3	-	-	-	39.1	39.4
3. Oceanography	-	-	23.5	-	19.5	43
4. Hydrography	-	-	-	-	39.4	39.4
5. Water Resource Study and Co-ordination	-	-	18.1	0.8	19	37.9
Sub-total	2.3	-	51	0.8	151.9	206
TOTAL	41.3	16.40	97.85	9.4	444.7	609.65

* Major federal agencies such as the Department of Defence, Department of Transport are not included because no estimate was available.

‡ Does not include regional staff of 37 professionals who devote part of their time to water-related activities.

TABLE 4-2

Summary of Estimated Operating Expenditures - by Area of Use and Control

(Dollars)

Purpose	Operating Expenditures - Estimated 1968-69					
	N.B.	Nfld.	N.S.	P.E.I.	Gov't of Canada	Total
A. Consumptive and Non-Consumptive Use						
1. Water Supply and Waste Disposal	-	2,713,400	337,000	40,000	2,402,500	5,492,900
2. Recreation						
Fish and Wildlife Conservation	284,700	-	-	35,000	40,000	359,700
Other	21,000	-	32,500	-	90,000	143,500
3. Power	3,000,000	3,242,000	522,500	-	7,705,900	14,470,400
4. Fisheries	-	-	44,300	-	1,667,400	1,711,700
5. Water Commerce (including Transportation and Log Driving)	-	-	-	-	201,000	201,000
6. Irrigation	64,300	-	-	-	See B(2)	64,300
Sub-total	3,370,000	5,955,400	936,300	75,000	12,106,800	22,443,500
B. Control						
1. Pollution Control	1,903,000	55,200	502,900	123,200	2,154,300	4,738,600
2. Soil and Water Conservation	311,300	250,000	529,800	110,000	170,000	1,371,100
3. Flood Control	-	-	150,000	-	346,000	496,000
Sub-total	2,214,300	305,200	1,182,700	233,200	2,670,300	6,605,700
C. Planning, Research and Data Collection						
1. Hydrology						
Groundwater Research	} 197,200	-	237,900	-	72,500	} 821,700
Surface Water Data Collection		5,500	7,000	-	301,000	
Hydrometeorological Research and Data Collection	-	-	-	-	*	
2. Anti-Pollution Research	-	-	27,900	-	n.a.‡	27,900
3. Oceanography	-	-	559,600	-	2,333,300	2,892,900
4. Water Quality Studies	7,000	6,400	6,000	-	90,000	109,400
5. Water-Related Research	-	-	135,000	-	22,500	157,500
6. Water Resource Study and Co-ordination	-	-	-	429,500†	1,025,000	1,454,500
Sub-total	204,200	11,900	974,000	429,500	3,844,300	5,463,900
TOTAL	5,788,500	6,272,500	3,093,000	737,700	18,621,400	34,513,100

* Total operating expenditures in the region are estimated at $7,500,000 but the water-oriented component is not available.

‡ At the time data was gathered, data was unavailable.

† This figure represents total anticipated expenditures on watershed studies. A breakdown was not available.

TABLE 4-3

Summary of Estimated Capital Expenditures - by Area of Use and Control

(Dollars)

Purpose	Estimated Capital Expenditures - 1968-69					
	N.B.	Nfld.	N.S.	P.E.I.	Gov't of Canada	Total
A. Consumptive and Non-Consumptive Use						
1. Water Supply and Waste Disposal	588,500	75,000	3,217,500	17,000	462,000	4,360,000
2. Recreation						
Fish and Wildlife Conservation	57,500	-	-	248,800*	170,000	476,300
Other	205,000	13,200	-	-	606,000	824,200
3. Power	-	17,754,000	2,814,700	-	-	20,568,700
4. Fisheries	-	-	-	-	1,119,000	1,119,000
5. Water Commerce (including Transportation and Log Driving)	-	-	-	-	70,000	70,000
6. Irrigation	-	-	-	-	See B(2)	-
Sub-total	851,000	17,842,200	6,032,200	265,800	2,427,000	27,418,200
B. Control						
1. Pollution Control	202,000	-	-	-	31,800	233,800
2. Soil and Water Conservation	-	-	669,900	25,000	1,374,000	2,068,900
3. Flood Control	-	-	150,000	-	-	150,000
Sub-total	202,000	-	819,900	25,000	1,405,800	2,452,700
C. Planning, Research and Data Collection						
1. Hydrology						
Groundwater Research	) 26,000	-	-	-	n.a.	-
Surface Water Data Collection	)	-	-	-	70,000	96,000
Hydrometeorological Research and Data Collection	-	-	-	-	n.a.	-
2. Anti-Pollution Research	-	-	-	-	15,000	15,000
3. Oceanography	-	-	n.a.	-	833,300	833,300
4. Water Quality Studies	20,000	-	-	-	-	20,000
5. Water-Related Research	-	-	-	-	-	-
6. Water Resource Study and Co-ordination	-	.	-	-	-	-
Sub-total	46,000	-	-	-	918,300	964,300
TOTAL	1,099,000	17,842,200	6,852,100	290,800	4,751,100	30,835,200

* Contingent on approval of FRED plan.

TABLE 4-4

Municipal Water, Sewer and Sewage Treatment Systems, Atlantic Provinces, Capital and Operating Costs to July 31, 1968

(Dollars)

Province	Capital Cost			Operating Cost			Dams-Reservoirs	
	Water Supply & Treatment	Sewer	Sewage Treatment	Water	Sewer	Sewage Treatment	Capital Cost	Operating Cost
New Brunswick	29,139,499	19,756,632	2,073,575	1,807,785	2,534,791	70,062	1,142,259	-
Newfoundland & Labrador	13,475,589	27,794,478	256,000	442,289	3,017,504	-	85,000	-
Nova Scotia	45,266,945	26,551,471	108,000	4,373,826	267,714	-	499,711	17,127
Prince Edward Island	3,617,159	2,485,530	-	462,748	218,862	-	-	-
Total	91,499,192	76,588,111	2,437,575	7,086,648	6,038,907	70,062	1,726,970	17,127

Notes:

1) Capital and operating costs show a breakdown among water supply and treatment, sewer and sewage treatment. In some cases costs have not been distributable among these three categories and have lumped in one category.

2) Costs shown are original costs, and the figures have not been adjusted for price changes.

3) Dams and reservoirs include only those built by municipalities for water supply purposes. Part of the total cost of dams may be included in the capital and operating costs shown above, but these could not be segregated during the study, due to accounting methods used by municipalities.

TABLE 4-5

Municipal Water, Sewer and Sewage Treatment Systems, Atlantic Provinces, Possible Future Expenditures*

(Dollars)

Province	Capital Cost‡				Annual Cost#
	Water Supply & Treatment		Sewer & Sewage Treatment		Water & Sewer
	Minimum	Maximum	Minimum	Maximum	
New Brunswick	22,809,072	26,277,072	18,151,489	22,579,419	1,141,536
Newfoundland & Labrador	20,829,904	27,899,741	12,746,796	14,056,314	2,037,161
Nova Scotia	21,693,437	24,234,998	17,088,466	23,764,566	2,146,871
Prince Edward Island	1,398,000	1,627,000	1,012,051	1,142,051	50,638
Total	66,730,413	80,038,811	48,998,802	61,542,350	5,376,206

* Based on consultant reports at July 1, 1968. There are some projects based on these reports which may have been undertaken since the collection of data, but information on progress was not available.

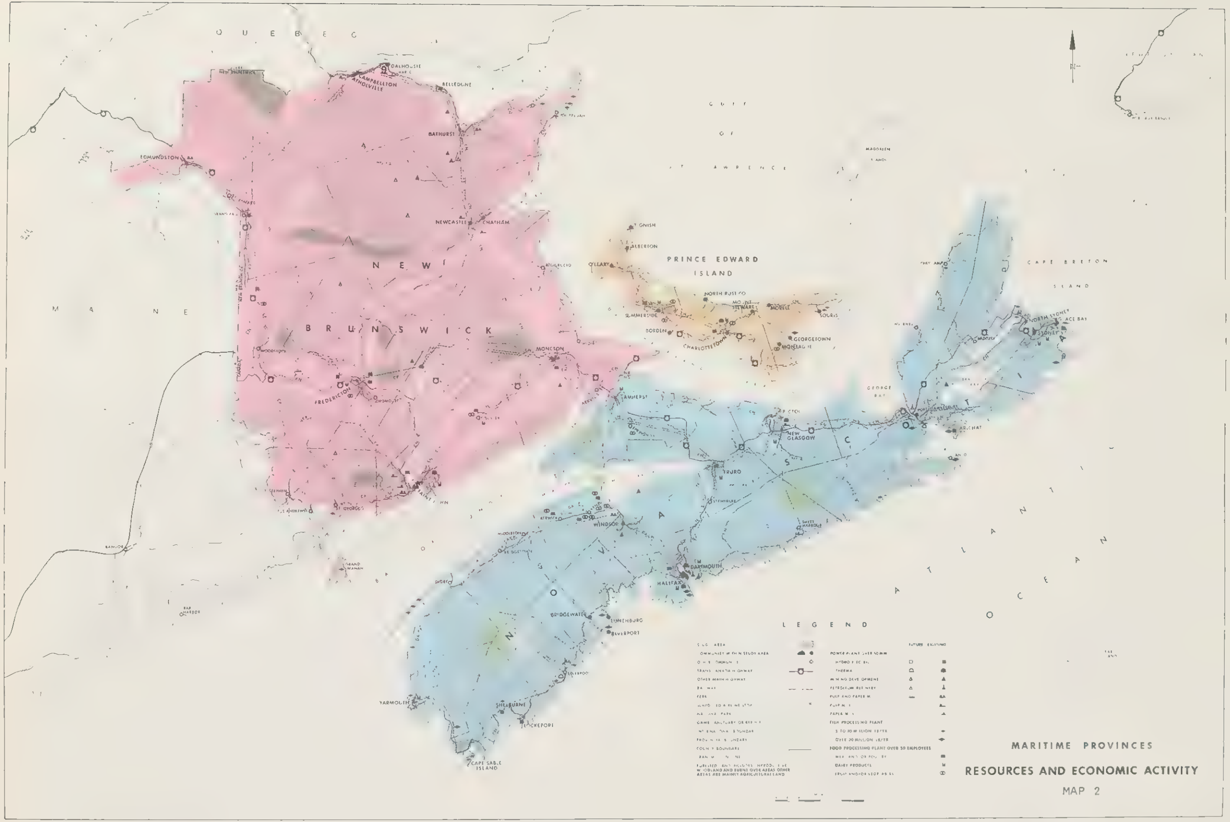
‡ Costs are original estimates and have not been adjusted for price changes.

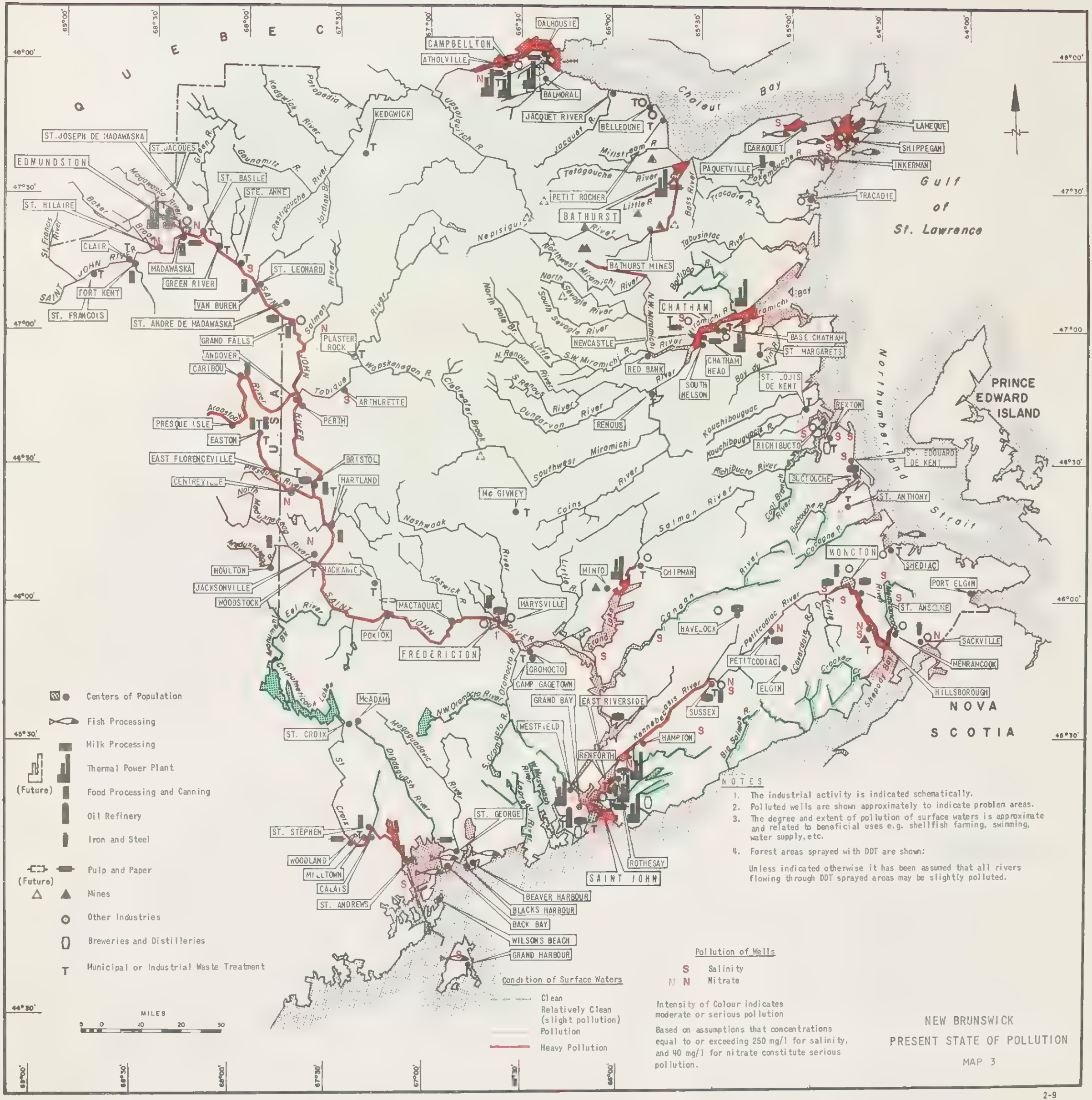
The total annual cost refers to those studies only for which this figure was available. The studies which included full operating costs and depreciation suggest that a reasonable operating cost figure would approximate 10% of capital costs. Water system operating costs run at approximately 12% of capital costs, while sewer system operating costs average about 9% of capital cost.

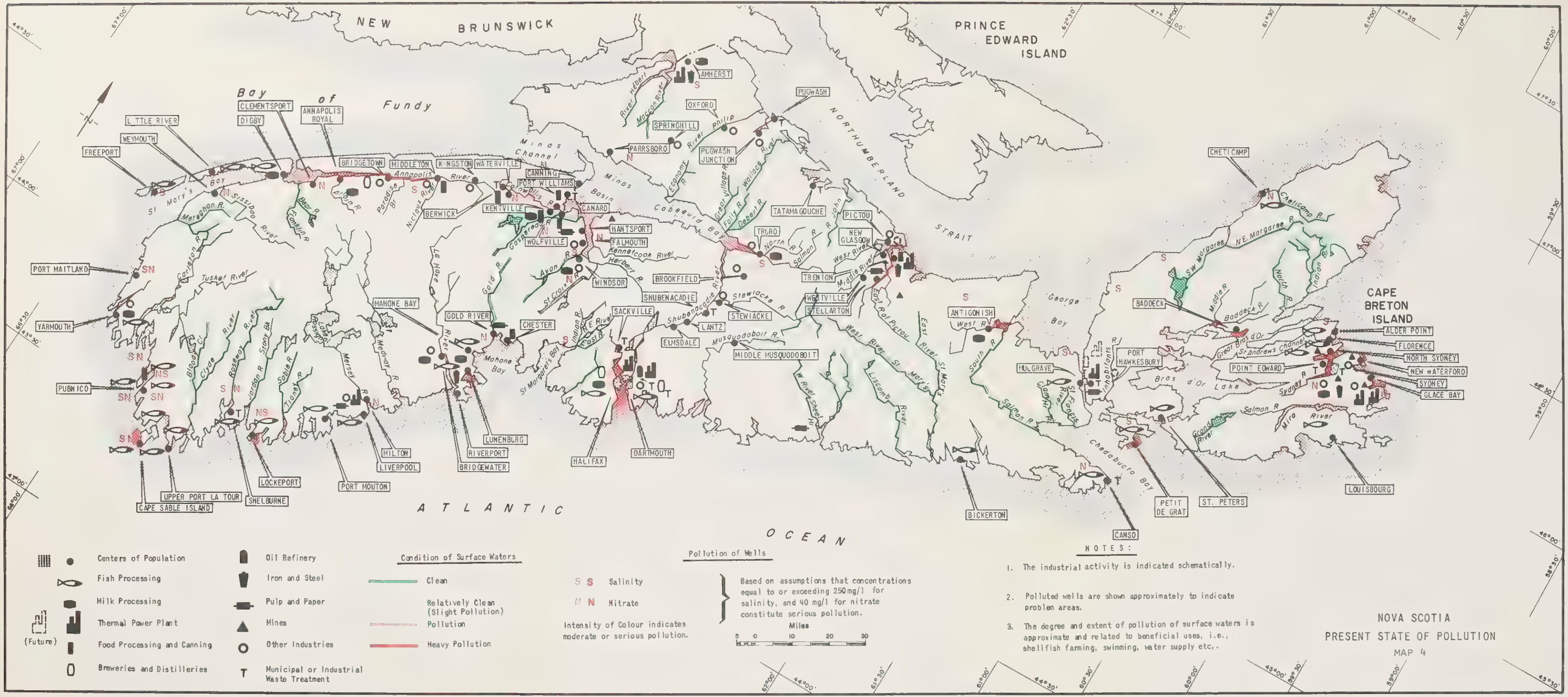
PART FIVE - MAPS

1. Maritime Provinces - Physiography
2. Maritime Provinces - Resources and Economic Activity
3. New Brunswick - Present State of Pollution
4. Nova Scotia - Present State of Pollution
5. Prince Edward Island - Present State of Pollution
6. Newfoundland and Labrador - River Basins and Study Areas
7. Newfoundland and Labrador - Water Availability and Water Usage
8. Exploits River Basin and the Badger - Botwood Study Area
9. Humber River Basin and the Corner Brook - Deer Lake Study Area
10. South Coast River Basins and Bay d'Espoir Study Area.
11. Terra Nova River Basin
12. Gander River Basin and Gander - Glenwood Study Area
13. Cat Arm River Basin
14. Piper's Hole River Basin
15. Churchill River Basin and Labrador City Study Area
16. St. Johns Study Area
17. Come by Chance Study Area
18. Burin Peninsula Study Area
19. Stephenville and Environs Study Area
20. Bonavista Peninsula Study Area

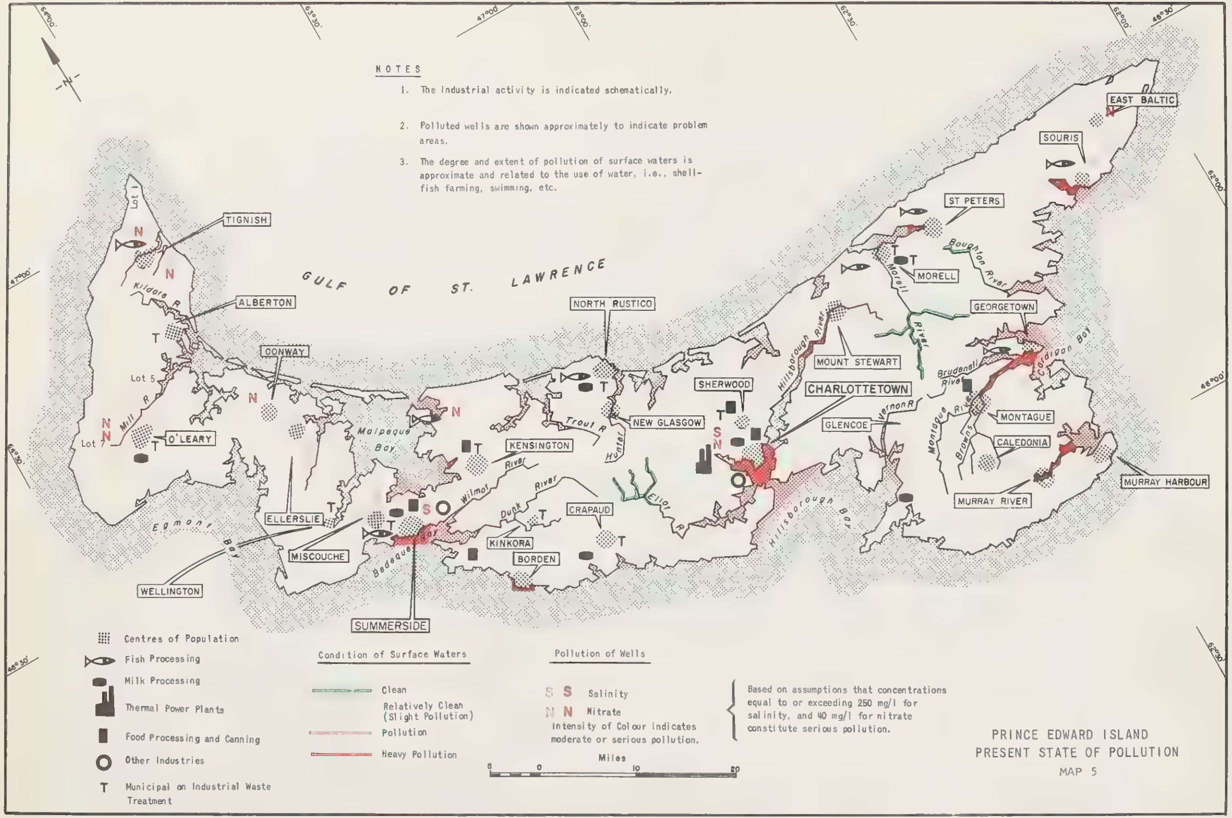
QUEBEC
NEWFOUNDLAND
GULF OF ST LAWRENCE
MAINE
NEW BRUNSWICK
PRINCE EDWARD ISLAND
CAPE BRETON ISLAND
NOVA SCOTIA
ATLANTIC OCEAN
BAY OF FUNDY
LEGEND
ELEVATION OF LAND
ABOVE 1500
0 - 500
MARITIME PROVINCES
PHYSIOGRAPHY
MAP 1


QUEBEC
NEW BRUNSWICK
PRINCE EDWARD ISLAND
NOVA SCOTIA
MAINE
ATLANTIC OCEAN
CAPE BRETON ISLAND
EDMUNDSTON
CAMPBELLTON
DALHOUSIE
BATHURST
NEWCASTLE
CHATHAM
MONCTON
FREDERICTON
SUMMERSIDE
CHARLOTTETOWN
GEORGETOWN
SOURIS
NEW GLASGOW
TRURO
WINDSOR
DARTMOUTH
HALIFAX
BRIDGEWATER
YARMOUTH
SHELBURNE
CAPE SABLE ISLAND
NORTH SYDNEY
SYDNEY
LEGEND
MARITIME PROVINCES
RESOURCES AND ECONOMIC ACTIVITY
MAP 2


QUEBEC
Chaleur Bay
Gulf of St. Lawrence
Northumberland Strait
PRINCE EDWARD ISLAND
NOVA SCOTIA
U.S.A.
CAMPBELLTON
DALHOUSIE
ATHOLVILLE
BALMORAL
JACQUET RIVER
BELLEDUNE
KEDGWICK
ST.JOSEPH DE MADAWASKA
ST.JACQUES
EDMUNDSTON
ST. BASILE
STE. ANNE
ST. HILAIRE
CLAIR
MADAWASKA
GREEN RIVER
FORT KENT
ST. FRANCOIS
ST. LEONARD
VAN BUREN
ST. ANDRE DE MADAWASKA
GRAND FALLS
PLASTER ROCK
ANDOVER
CARIBOU
PRESQUE ISLE
EASTON
ARTHURETTE
PERTH
BRISTOL
HARTLAND
EAST FLORENCEVILLE
CENTREVILLE
HOULTON
JACKSONVILLE
WOODSTOCK
MACTAQUAC
POKIOK
FREDERICTON
MARYSVILLE
OROMOCTO
CAMP GAGETOWN
McADAM
ST. CROIX
ST. STEPHEN
WOODLAND
MILLTOWN
CALAIS
ST. ANDREWS
ST. GEORGE
BEAVER HARBOUR
BLACKS HARBOUR
BACK BAY
WILSONS BEACH
GRAND HARBOUR
GRAND BAY
WESTFIELD
EAST RIVERSIDE
RENFORTH
ROTHESAY
SAINT JOHN
HAMPTON
SUSSEX
PETITCODIAC
ELGIN
HAVELOCK
MINTO
CHIPMAN
Mc GIVNEY
MONCTON
SHEDIAC
PORT ELGIN
ST. ANSELME
SACKVILLE
MEMRAMCOOK
HILLSBOROUGH
ST. ANTHONY
BUCTOUCHE
ST. EDOUARD DE KENT
RICHIBUCTO
REXTON
ST. LOUIS DE KENT
CHATHAM
NEWCASTLE
RED BANK
CHATHAM HEAD
SOUTH NELSON
BASE CHATHAM
ST MARGARETS
RENOUS
BATHURST MINES
BATHURST
PETIT ROCHER
PAQUETVILLE
CARAQUET
LAMEQUE
SHIPPEGAN
INKERMAN
TRACADIE
Saint John River
Miramichi River
Restigouche River
Nepisiguit River
Southwest Miramichi
Kennebecasis River
Petitcodiac River
Canaan River
Salmon River
Tobique R.
Centers of Population
Fish Processing
Milk Processing
Thermal Power Plant
(Future)
Food Processing and Canning
Oil Refinery
Iron and Steel
Pulp and Paper
(Future)
Mines
Other Industries
Breweries and Distilleries
Municipal or Industrial Waste Treatment
MILES
0 10 20 30
NOTES
1. The industrial activity is indicated schematically.
2. Polluted wells are shown approximately to indicate problem areas.
3. The degree and extent of pollution of surface waters is approximate and related to beneficial uses e.g. shellfish farming, swimming, water supply, etc.
4. Forest areas sprayed with DDT are shown:
Unless indicated otherwise it has been assumed that all rivers flowing through DDT sprayed areas may be slightly polluted.
Pollution of Wells
S Salinity
N N Nitrate
Condition of Surface Waters
Clean
Relatively Clean (slight pollution)
Pollution
Heavy Pollution
Intensity of Colour indicates moderate or serious pollution
Based on assumptions that concentrations equal to or exceeding 250 mg/l for salinity, and 40 mg/l for nitrate constitute serious pollution.
NEW BRUNSWICK
PRESENT STATE OF POLLUTION
MAP 3



NOVA SCOTIA
PRESENT STATE OF POLLUTION
MAP 4



NOTES
1. The industrial activity is indicated schematically.
2. Polluted wells are shown approximately to indicate problem areas.
3. The degree and extent of pollution of surface waters is approximate and related to the use of water, i.e., shell-fish farming, swimming, etc.
GULF OF ST. LAWRENCE
TIGNISH
ALBERTON
Kildare R
Lot 1
Lot 5
Lot 7
Mill R
O'LEARY
CONWAY
ELLERSLIE
MISCOUCHE
WELLINGTON
Egmont Bay
Malpeque Bay
Bedeque Bay
SUMMERSIDE
KENSINGTON
Wilmot River
Dunk River
KINKORA
BORDEN
CRAPAUD
NORTH RUSTICO
Trout R
Hunter R
NEW GLASGOW
Elliot R
SHERWOOD
CHARLOTTETOWN
Hillsborough River
Hillsborough Bay
MOUNT STEWART
GLENCOE
Vernon R
Morell River
MORELL
Boughton River
GEORGETOWN
Cardigan Bay
Brudenell River
Montague River
Browns
MONTAGUE
CALEDONIA
MURRAY RIVER
MURRAY HARBOUR
ST PETERS
SOURIS
EAST BALTIC
N
Centres of Population
Fish Processing
Milk Processing
Thermal Power Plants
Food Processing and Canning
Other Industries
Municipal on Industrial Waste Treatment
Condition of Surface Waters
Clean
Relatively Clean (Slight Pollution)
Pollution
Heavy Pollution
Pollution of Wells
S S Salinity
N N Nitrate
Intensity of Colour indicates moderate or serious pollution.
Based on assumptions that concentrations equal to or exceeding 250 mg/l for salinity, and 40 mg/l for nitrate constitute serious pollution.
Miles
0
10
20
PRINCE EDWARD ISLAND
PRESENT STATE OF POLLUTION
MAP 5

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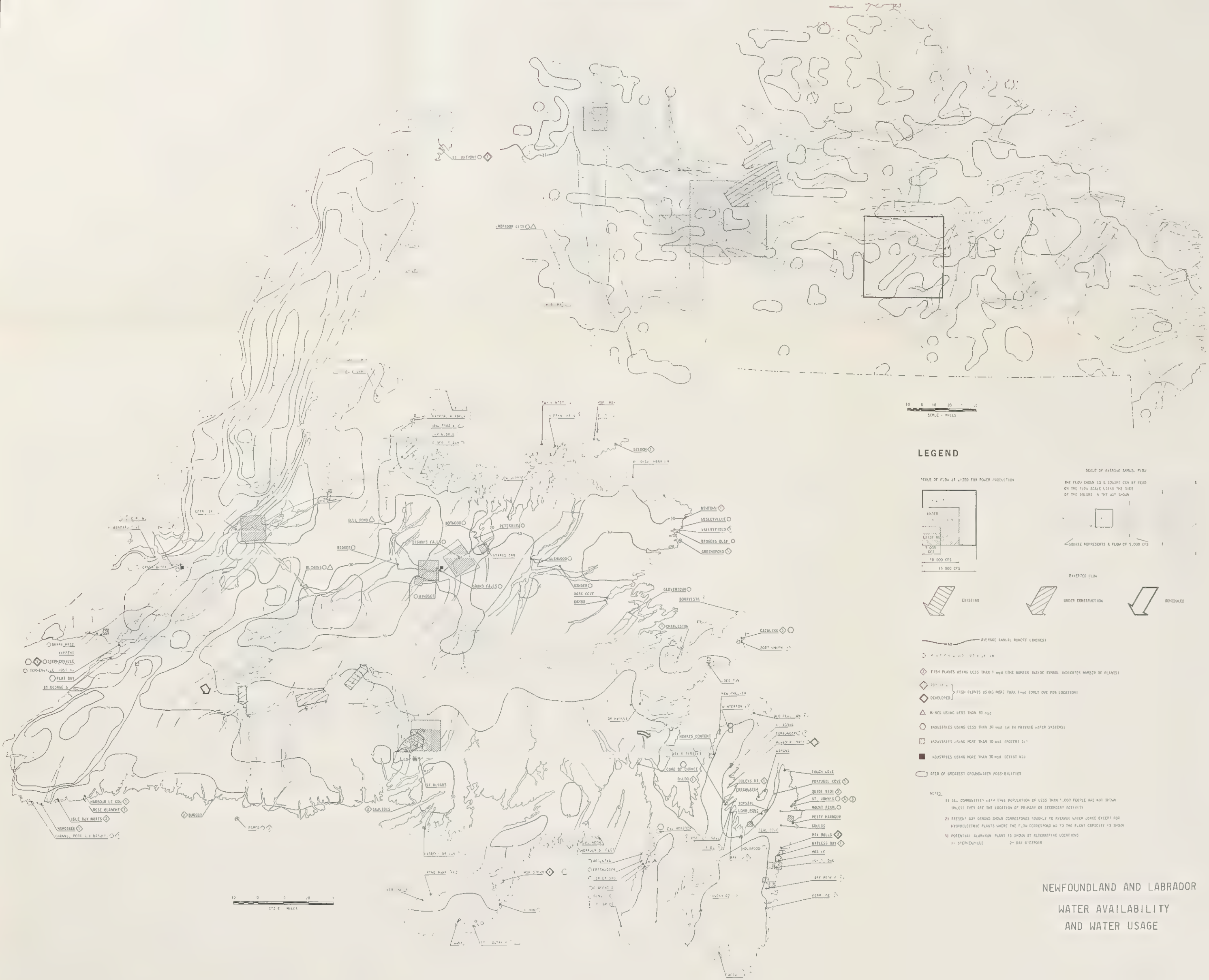

NEWFOUNDLAND AND LABRADOR
WATER AVAILABILITY
AND WATER USAGE

MAP 7

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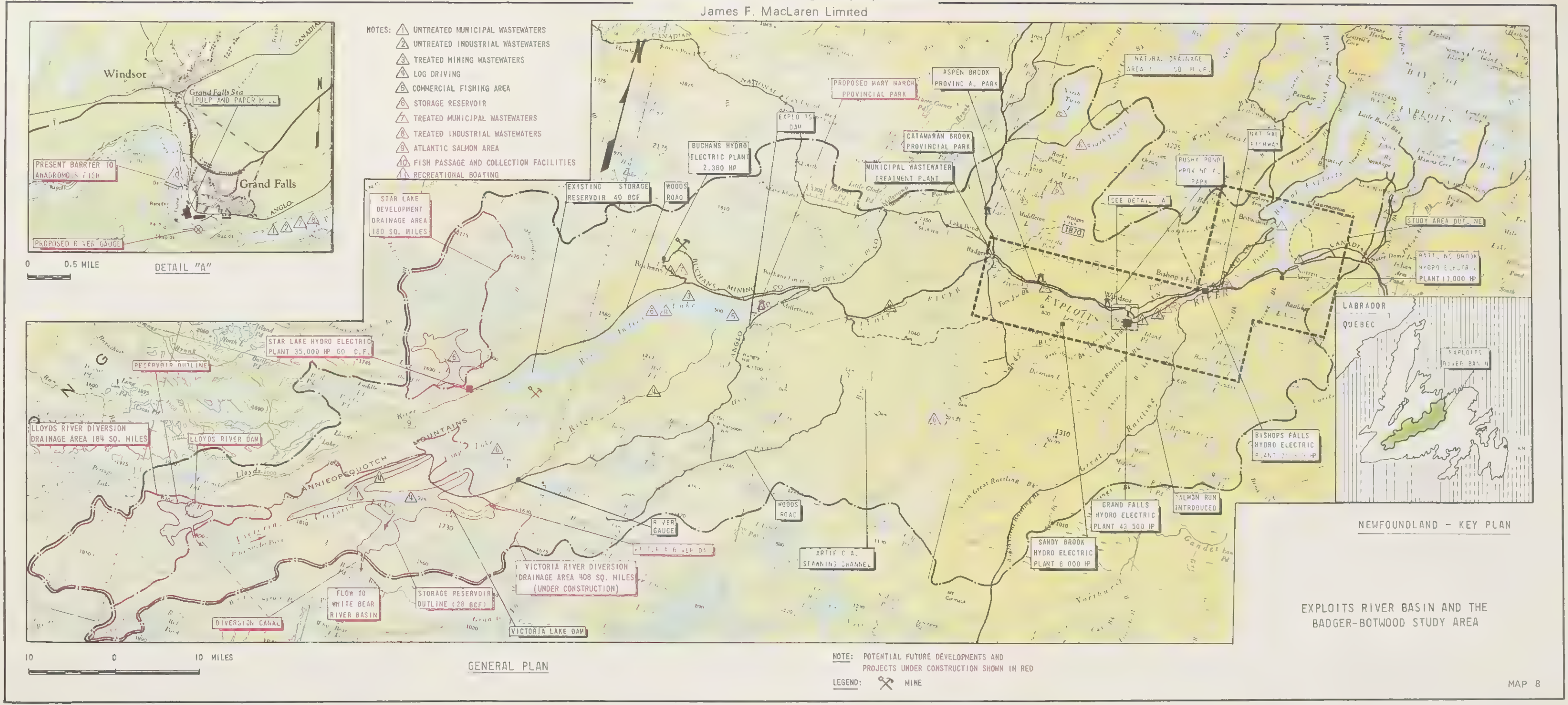
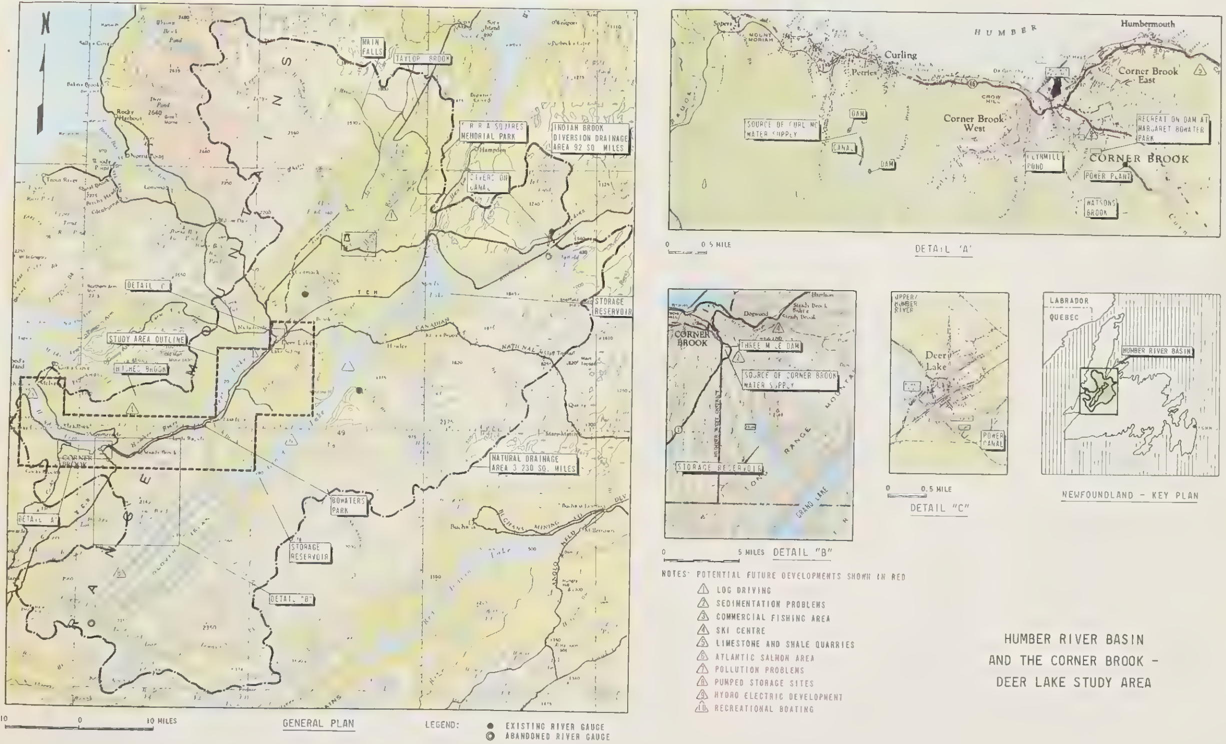
James F. MacLaren Limited



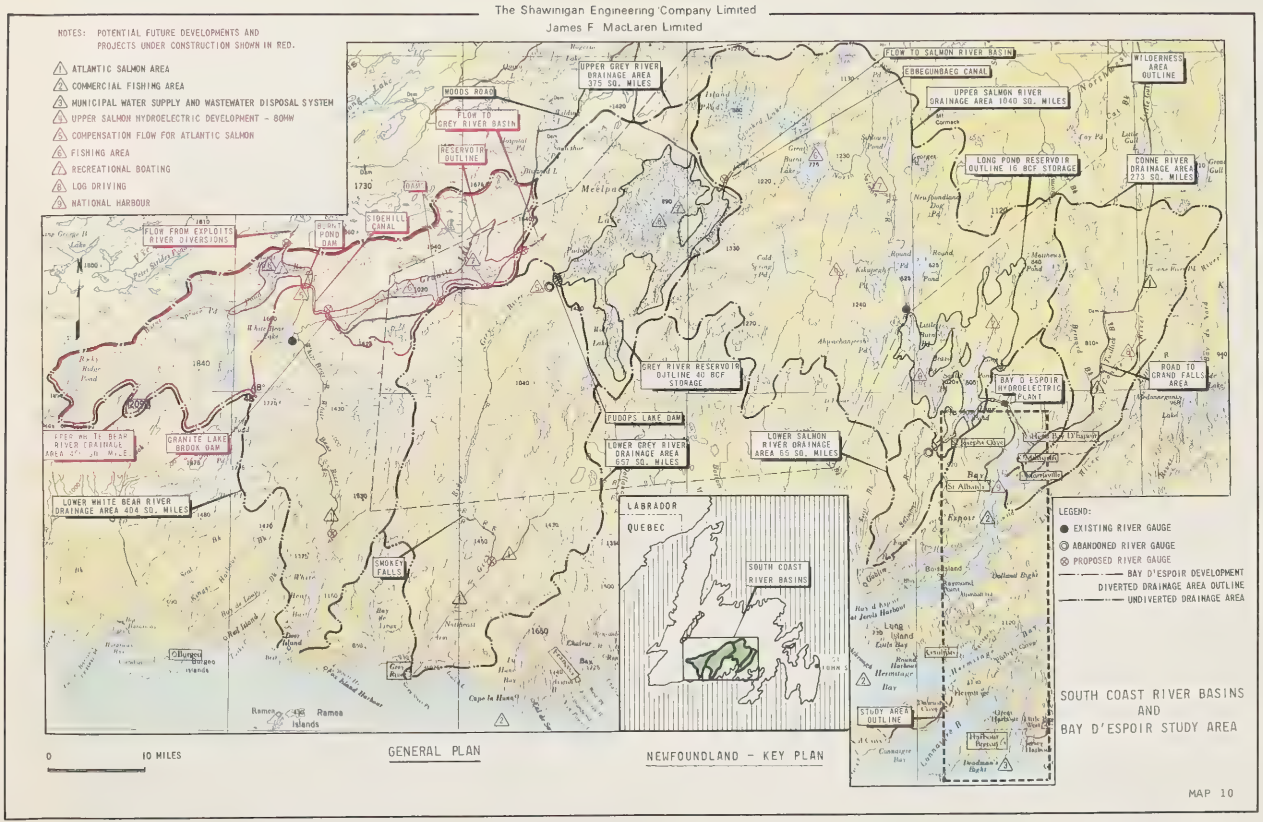
EXPLOITS RIVER BASIN AND THE BADGER-BOTWOOD STUDY AREA

MAP 8



HUMBER RIVER BASIN
AND THE CORNER BROOK -
DEER LAKE STUDY AREA

MAP 9


The Shawinigan Engineering Company Limited
James F MacLaren Limited
NOTES: POTENTIAL FUTURE DEVELOPMENTS AND PROJECTS UNDER CONSTRUCTION SHOWN IN RED.
1 ATLANTIC SALMON AREA
2 COMMERCIAL FISHING AREA
3 MUNICIPAL WATER SUPPLY AND WASTEWATER DISPOSAL SYSTEM
4 UPPER SALMON HYDROELECTRIC DEVELOPMENT - 80MW
5 COMPENSATION FLOW FOR ATLANTIC SALMON
6 FISHING AREA
7 RECREATIONAL BOATING
8 LOG DRIVING
9 NATIONAL HARBOUR
UPPER GREY RIVER DRAINAGE AREA 375 SQ. MILES
WOODS ROAD
FLOW TO GREY RIVER BASIN
RESERVOIR OUTLINE
DAM
SIDEHILL CANAL
BURNT POND DAM
FLOW FROM EXPLOITS RIVER DIVERSIONS
GRANITE LAKE BROOK DAM
LOWER WHITE BEAR RIVER DRAINAGE AREA 404 SQ. MILES
SMOKEY FALLS
GREY RIVER RESERVOIR OUTLINE 40 BCF STORAGE
PUDOPS LAKE DAM
LOWER GREY RIVER DRAINAGE AREA 657 SQ. MILES
LOWER SALMON RIVER DRAINAGE AREA 69 SQ. MILES
FLOW TO SALMON RIVER BASIN
EBBEGUNBAEG CANAL
UPPER SALMON RIVER DRAINAGE AREA 1040 SQ. MILES
WILDERNESS AREA OUTLINE
LONG POND RESERVOIR OUTLINE 16 BCF STORAGE
CONNE RIVER DRAINAGE AREA 273 SQ. MILES
BAY D ESPOIR HYDROELECTRIC PLANT
ROAD TO GRAND FALLS AREA
STUDY AREA OUTLINE
LABRADOR
QUEBEC
SOUTH COAST RIVER BASINS
LEGEND:
EXISTING RIVER GAUGE
ABANDONED RIVER GAUGE
PROPOSED RIVER GAUGE
BAY D'ESPOIR DEVELOPMENT DIVERTED DRAINAGE AREA OUTLINE
UNDIVERTED DRAINAGE AREA
0 10 MILES
GENERAL PLAN
NEWFOUNDLAND - KEY PLAN
SOUTH COAST RIVER BASINS AND BAY D'ESPOIR STUDY AREA
MAP 10

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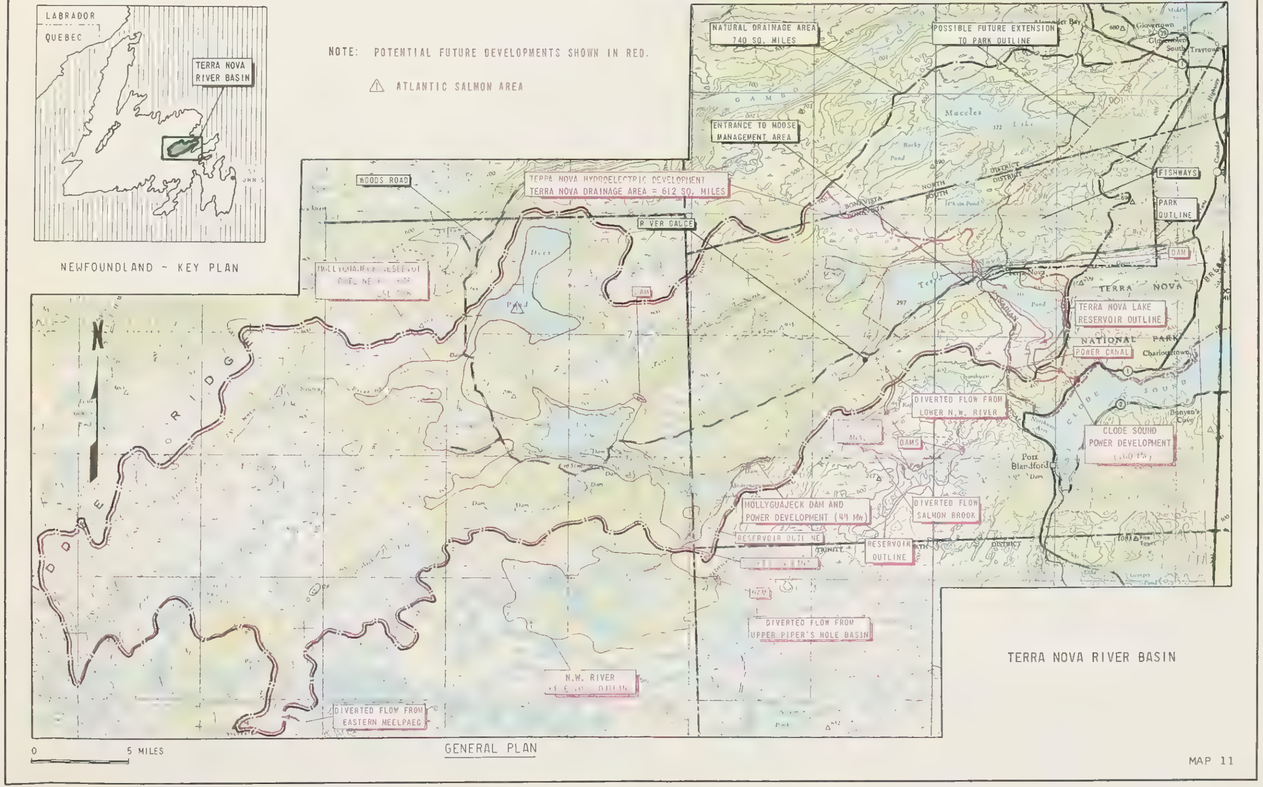

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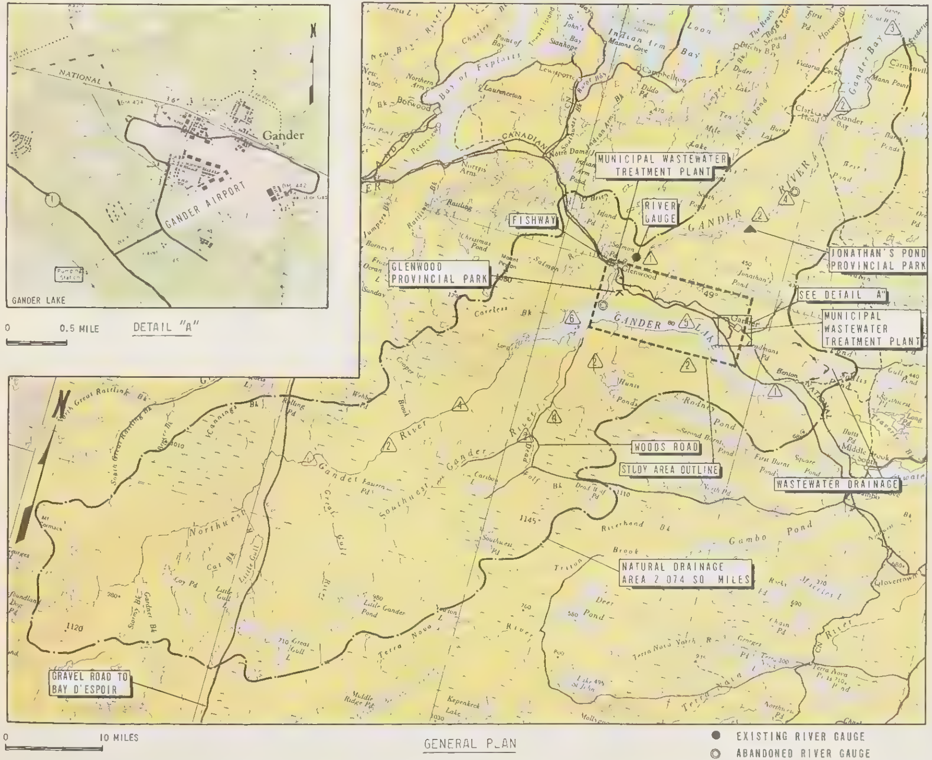


NEWFOUNDLAND - KEY PLAN

NOTE:

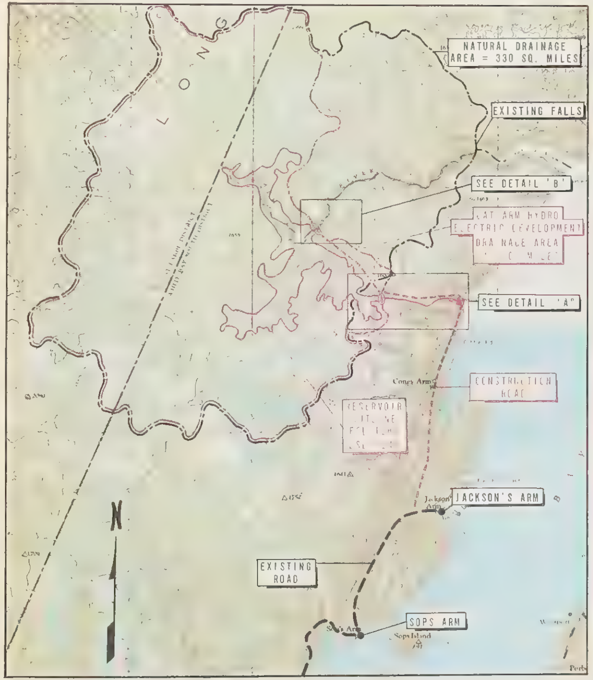
1. TREATED MUNICIPAL WASTEWATERS
2. ATLANTIC SALMON AREA
3. COMMERCIAL FISHING AREA
4. SMALL DRAUGHT NAVIGATION
5. RECREATIONAL BOATING
6. LOG DRIVING

POTENTIAL FUTURE DEVELOPMENTS SHOWN IN RED

● EXISTING RIVER GAUGE
◎ ABANDONED RIVER GAUGE

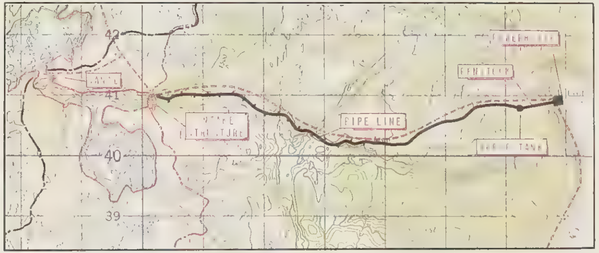
GANDER RIVER BASIN AND GANDER-GLENWOOD STUDY AREA

MAP 12



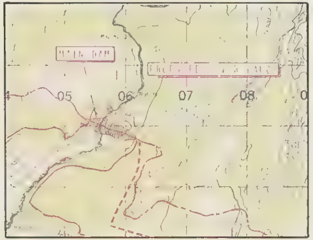
0 5 MILES

GENERAL PLAN



0 0.5 MILE

DETAIL "A"



0 0.5 MILE

DETAIL "B"

NEWFOUNDLAND - KEY PLAN

CAT ARM RIVER BASIN

NOTE: POTENTIAL FUTURE DEVELOPMENT SHOWN IN RED

MAP 13

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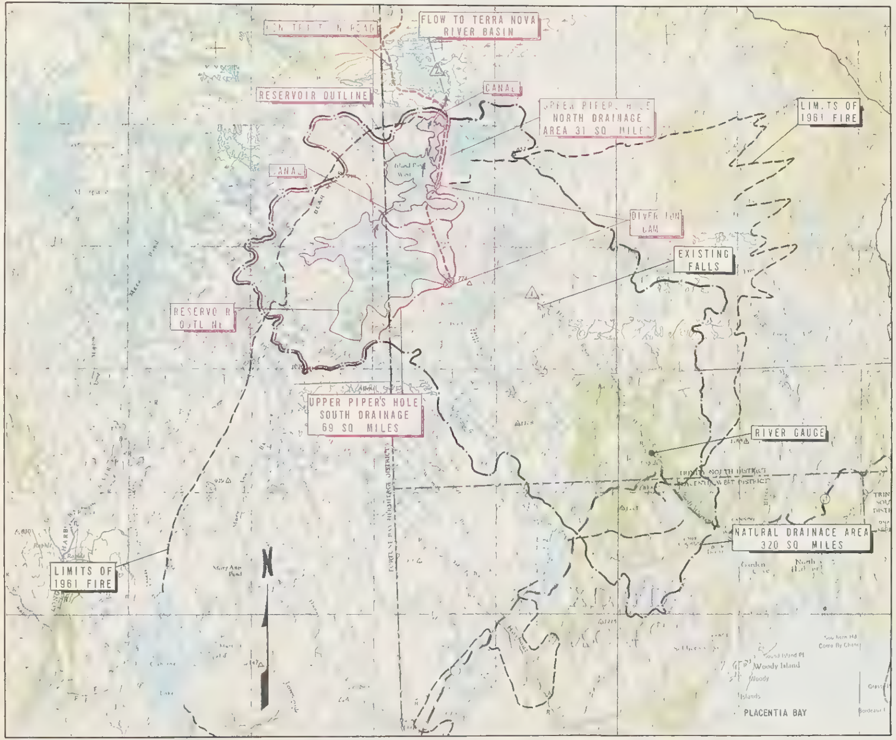
James F. MacLaren Limited



0 5 MILES

GENERAL PLAN

NEWFOUNDLAND - KEY PLAN

NOTE: POTENTIAL FUTURE DEVELOPMENTS SHOWN IN RED.

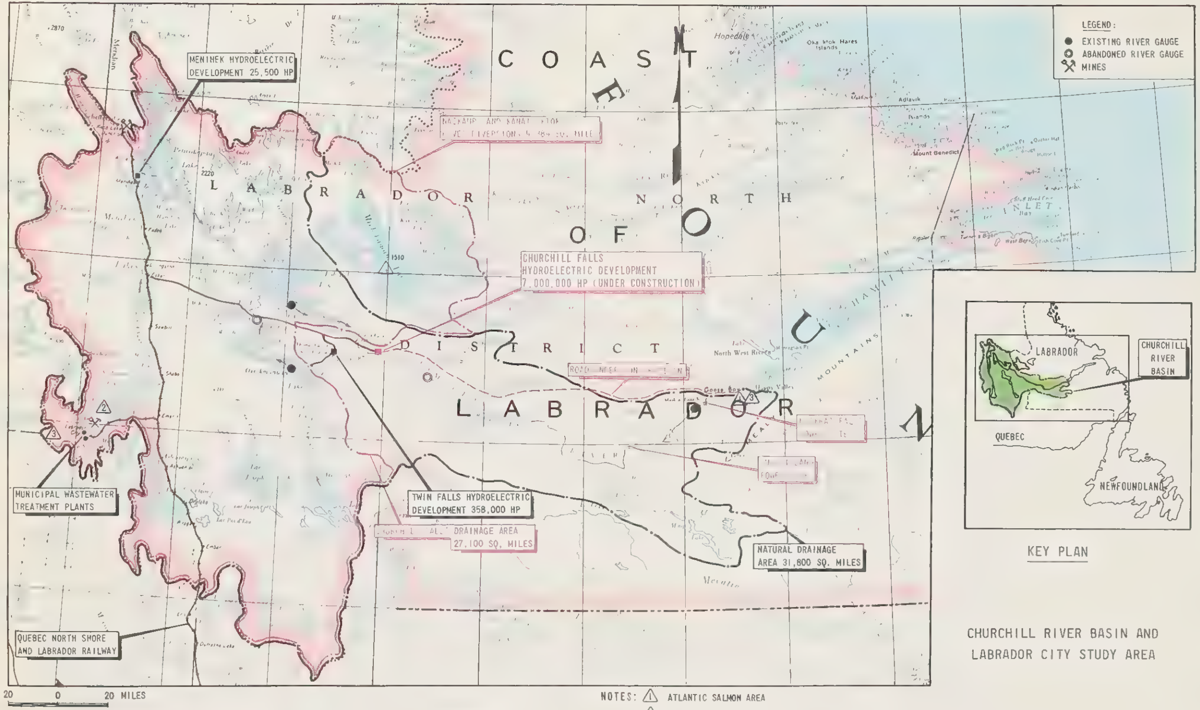
⚠1 ATLANTIC SALMON AREA UPSTREAM OF EXISTING FALLS.

⚠2 UPPER AREA DIVERSION TO TERRA NOVA HYDROELECTRIC DEVELOPMENT

PIPER'S HOLE RIVER BASIN

MAP 14

1



GENERAL PLAN

KEY PLAN

CHURCHILL RIVER BASIN AND
LABRADOR CITY STUDY AREA

NOTES: 1) FOR CLARITY OF PRESENTATION FUTURE POWER STRUCTURES AND RESERVOIR OUTLINES NOT SHOWN

2) POTENTIAL FUTURE DEVELOPMENTS AND PROJECTS UNDER CONSTRUCTION SHOWN IN RED

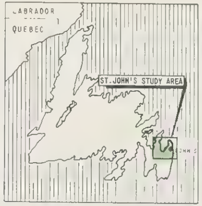
NOTES:
1. ATLANTIC SALMON AREA
2. MINING POLLUTION
3. MUNICIPAL WATER SUPPLY AND WASTEWATER DISPOSAL SYSTEMS
4. COMMERCIAL FRESH WATER FISHING AREA
5. LOG DRIVING

MAP 15

The Shawinigan Engineering Company Limited
James F. MacLaren Limited

0 5 10 MILES

GENERAL PLAN



NEWFOUNDLAND - KEY PLAN

NOTES: POTENTIAL FUTURE DEVELOPMENTS AND PROJECTS UNDER CONSTRUCTION SHOWN IN RED
1. POLLUTION PROBLEMS AFFECTING RECREATIONAL USE OF WATER
2. POLLUTION PROBLEMS CREATING DIRECT HEALTH HAZARD
3. LICENSED SALMON RIVER
4. WATER SUPPLY STORAGE RESERVOIR
5. COMMERCIAL FISHING AREA
6. WATER METER INSTALLATION PROGRAM
7. SANITARY FLOW DISCHARGE FROM ST. JOHN'S
8. REGIONAL WATER SUPPLY FACILITIES
9. POSSIBLE FUTURE ST. JOHN'S WATER SUPPLY SOURCE
10. STORAGE RESERVOIR SITES

LEGEND:
W S COMMUNITY WITH WATER SUPPLY AND WASTEWATER DISPOSAL SYSTEMS
W S COMMUNITY WITH WASTEWATER DISPOSAL SYSTEM ONLY

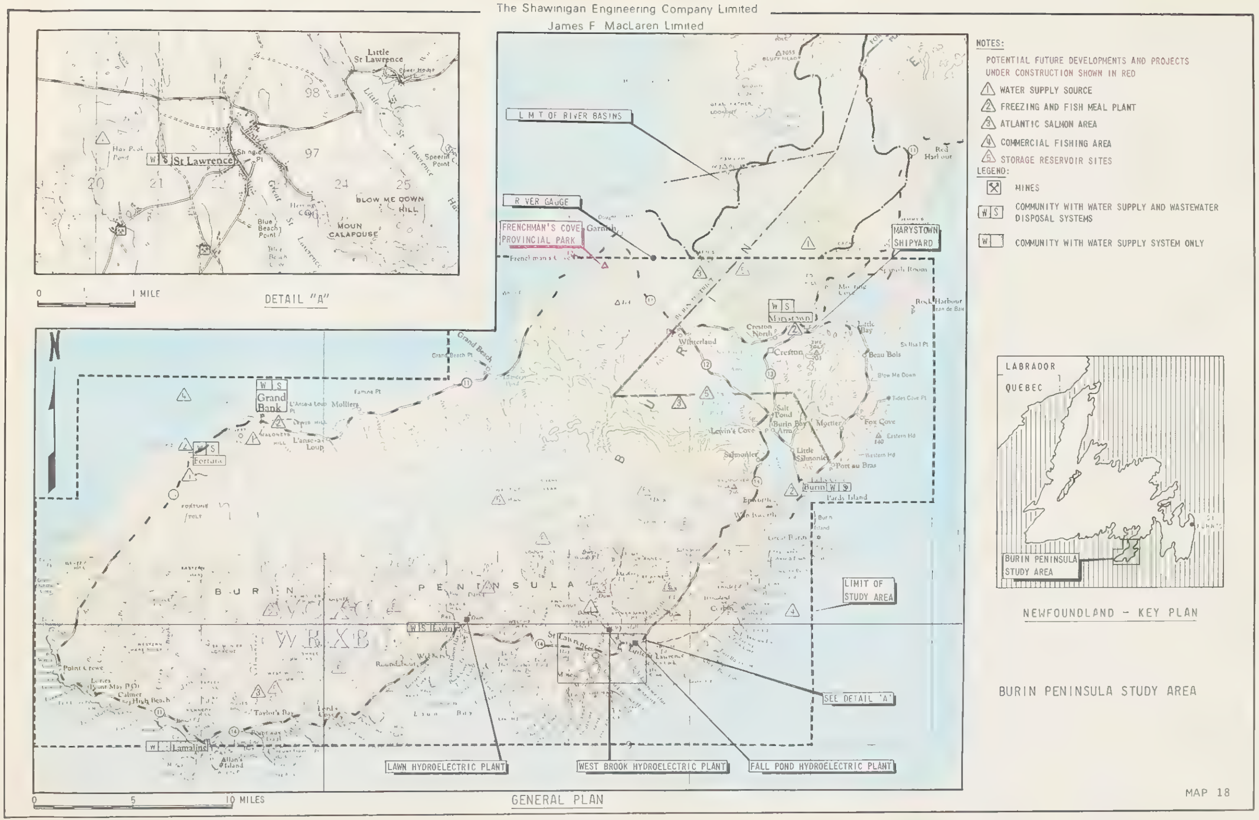
0 1/2 1 MILE

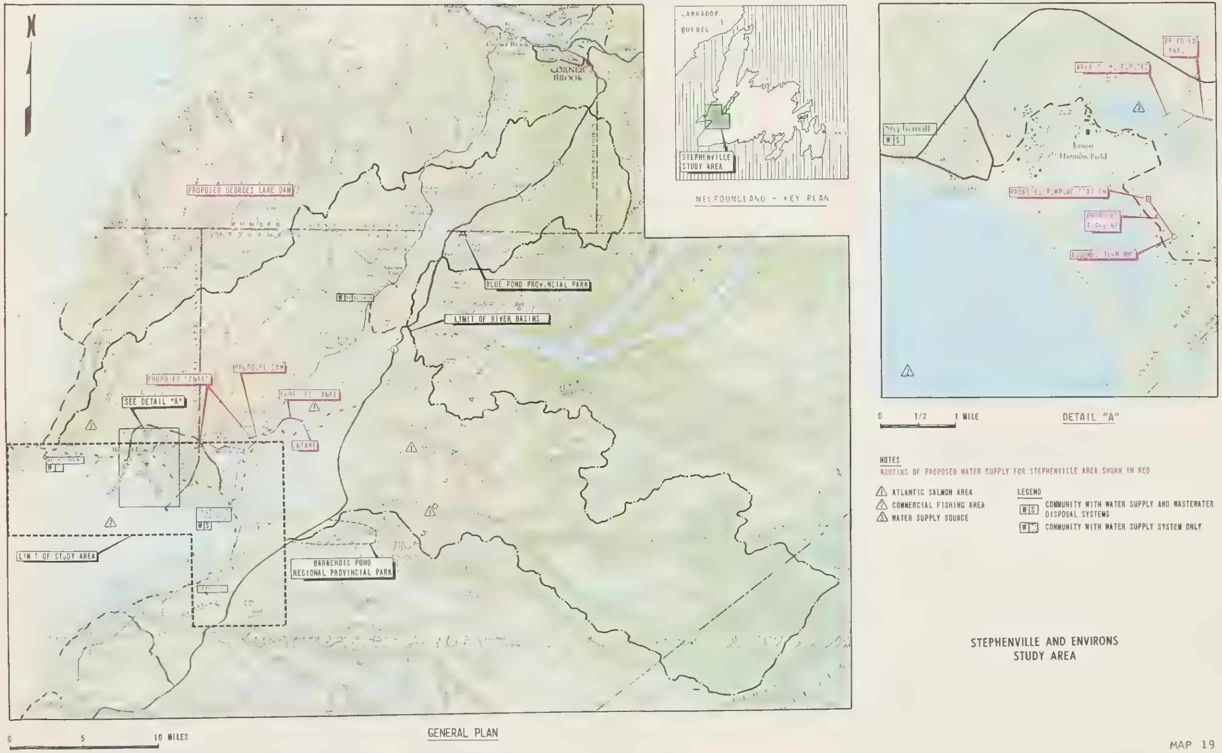
DETAIL "A"

MAP 16

The Shawinigan Engineering Company Limited
James F MacLaren Limited

MAP 17


The Shawinigan Engineering Company Limited
James F MacLaren Limited
NOTES:
POTENTIAL FUTURE DEVELOPMENTS AND PROJECTS UNDER CONSTRUCTION SHOWN IN RED
1 WATER SUPPLY SOURCE
2 FREEZING AND FISH MEAL PLANT
3 ATLANTIC SALMON AREA
4 COMMERCIAL FISHING AREA
5 STORAGE RESERVOIR SITES
LEGEND:
MINES
W S COMMUNITY WITH WATER SUPPLY AND WASTEWATER DISPOSAL SYSTEMS
W COMMUNITY WITH WATER SUPPLY SYSTEM ONLY
DETAIL "A"
0 1 MILE
St Lawrence
Little St Lawrence
BLOW ME DOWN HILL
MOUN CALAPOUSE
LIMIT OF RIVER BASINS
RIVER GAUGE
FRENCHMAN'S COVE PROVINCIAL PARK
MARYSTOWN SHIPYARD
Marystown
Grand Bank
Fortune
Lawn
Lamaline
Burin
BURIN PENINSULA
LIMIT OF STUDY AREA
SEE DETAIL 'A'
LAWN HYDROELECTRIC PLANT
WEST BROOK HYDROELECTRIC PLANT
FALL POND HYDROELECTRIC PLANT
0 5 10 MILES
GENERAL PLAN
LABRADOR
QUEBEC
BURIN PENINSULA STUDY AREA
NEWFOUNDLAND - KEY PLAN
BURIN PENINSULA STUDY AREA
MAP 18

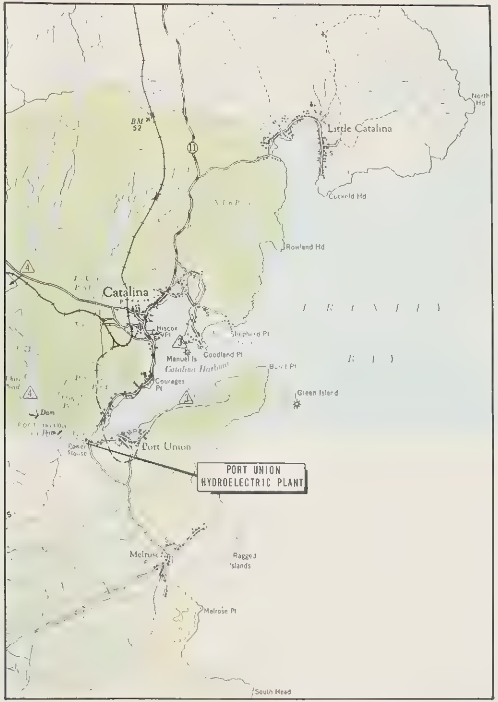


STEPHENVILLE AND ENVIRONS
STUDY AREA

MAP 19

GENERAL PLAN

0 5 MILES



DETAIL "A"

0 1/2 MILE

NEWFOUNDLAND - KEY PLAN

NOTES: POTENTIAL FUTURE DEVELOPMENTS SHOWN IN RED

- 1 ATLANTIC SALMON AREA
- 2 COMMERCIAL FISHING
- 3 FISH PROCESSING PLANTS
- 4 POSSIBLE STORAGE RESERVOIR

BONAVISTA PENINSULA

STUDY AREA

MAP 20